The effects of brain trauma on the memory skills of musicians

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Abstract

The localization of function in terms of music processing in the brain has fascinated researchers in many disciplines for well over one hundred years. Is there a central location for this specialized and complex process or does it involve many different areas of the brain? Some researchers have thought that the processing of language and music are analogous, but does the processing of music occur in the same way as language (Damasio and Damasio, 1977), (Zatorre, 1984)? In recent years the use of non-invasive imaging techniques such as the PET scan (Positron Emission Tomography) and MRI (Magnetic Resonance Imaging) have proven to be most accurate in the demonstration of brain activity (Vollmer-Haase et al., 1998) and have led researchers to agree that there is not a specific anatomical centre for music in the brain (Baeck, 2002), (Peretz, 2002).

This thesis will examine in what way and to what degree various types of Traumatic Brain Injury in musicians affect music memory. A pilot study was conducted with musicians who have not experienced brain trauma. These musicians were asked to complete a questionnaire and then were interviewed in order to understand the process with which they utilize their musical memory. Six brain-injured musicians were also interviewed in the same manner. When possible, medical records were solicited and reviewed as a means of ascertaining specifics regarding the trauma. Using then, a qualitative framework in a case study format, the questionnaire and the focused interviews will provide the data. (London, 1982), (Psathas, 1972). This format will provide a perspective that has been neglected in many studies in Neuromusicology, that of allowing the musicians to speak for themselves.

The interviews are a study of the personal reflections of the musicians who are commenting on their understanding of their own experiences of musical memory. While my interest does lie in the clinical evidence provided by researchers in the field of Neuromusicology and their insights into musical memory, there has not been any extensive work written which concerns itself with the personal experiences of musicians and their subjective interpretation of these memorization processes. The balance between the clinical evidence needs to be contrasted with the subjective elements of a person's self-perception and understanding. It is my aim in this study to explore these perceptions in the context of real life situations. It should also be noted that the observations made are a reflection of the subject's personal experiences and their subjective view of these experiences.

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1 Introduction

The purpose of my doctoral research is to examine in what way music memory is affected by various types of Traumatic Brain Injury (TBI) in musicians. The examination of this data will be looked at from the perspective of the musician and not a purely neurological look at their respective brains. The thrust then of this research is to delve into the mindset of the musicians to note their own understanding of the musical memory process. It should be noted at the outset that under the umbrella term of Traumatic Brain Injury I am including all trauma to the brain including brain insults. As will be stated later the six musicians I have interviewed have had various types of brain injuries. All those sustained by them have caused the brain to be traumatized, therefore I am using the umbrella term of Traumatic Brain Injury as a general descriptive term. Upon examination and comparison of the subjects' past health, and past musical abilities, with present medical evidence, and present musical ability, the discrepancies of memory pre and post trauma will be ascertained by means of observation, and interviews. The derived information will depend on several variables, including type of trauma, its location(s) in the brain, the severity of trauma, the rehabilitative steps taken by the subject thus far, and the overall emotional and psychological health of the subject. Other variables, such as personality traits that affect reaction to trauma, insurance coverage of medical treatment, actual treatment obtained, etc., will also affect the outcome.

The literature reveals that there has been much testing and experimentation done by diverse professionals (Serafine, 1981), (Hood, 1977), (Liegeois-Chauvel et al., 1998), (Trenerry & Loring, 1995) on musical memory and its relationship to a variety of disorders. Memory (Shumizu, 1987), (Parkin, 1987), and music psychological testing abounds (Gordon, 1982), (Dowling & Fujitani, 1971), but the use of the case study format for musical memory appears not to have been utilized, especially from those in the field of Neuromusicology or music psychology. This may have occurred because there are many academicians who feel that the laboratory and its clinical and controlled setting is the only place for 'real' research and that quantitative methods are the best avenue for understanding these realities. The strategies employed in this study are not quantitative. I will be using the case study format which is an empirical strategy that examines current issues and the nature of phenomenon within the context of real-life situations. This strategy will be based on a qualitative

methodology, which is reliant on the study of real phenomenon (Spradley, 1979), (Stubbs, 1983), (Dey, 1993). This kind of research explores the phenomena through the eyes of the person who is experiencing it, as opposed to through the eyes of the researcher. A qualitative study does not necessarily attempt to prove a theory or even to offer hypotheses, but rather to examine the world view and self perception that will provide the development and points of departure for future study (London, 1982), (Mishler, 1986), (Psathas, 1972). The 'proofs' are the actual facts of the phenomenon of which I am studying. I will be looking at real events and perceptions which are the realities in which the world is perceived and understood by each individual. This is their reality, and this reality is fact. The approach, which I have described, is widely accepted in the fields of psychology, anthropology, sociology, and education among others. It was paramount to my approach that there be observations of what the interviewee experiences through the trauma and subjective approach to dealing with the pain and suffering. I therefore used a semi-structured interview technique, to allow the interviewees worldviews to surface, and to give them the opportunity to express their own understanding of how these events have affected their lives. In a purely clinical setting, it would seem that the data elicited would be of a nature that would not allow the freedom that is readily identifiable in a qualitative study such as this.

I will include, at the end of this document, letters and questionnaires that I have sent to various health care professionals. Other pertinent information will be included, which will help explain the methodology employed. This information will include a cover letter with a call for participation, a questionnaire, and interview questions. As it is my focus to use a qualitative approach, the interview questions will provide a structure and direction, but will ultimately be used as a springboard to a more in depth dialogue. Because of the nature of my approach, I will not be expecting a finite number of answers to the interview questions, as the design of the questioning will be open ended. Each subject will lead me through my structured questioning into his or her own personal and unique direction. The questions will provide focus. Upon examination of the data I may find that there is an overlapping of ideas, concepts and world views, but this must be realized by the data received and not a result of my own preconceptions. In this thesis I have received the cooperation of six brain injured musicians. I am using the initials of the subjects to provide anonymity except in the case of

two of musicians. These two musicians are well known in their respective fields and would have been recognized fairly easily. The first is a jazz guitarist named Pat Martino, the second is a concert pianist whose name is Ana-Maria Trenchi De Bottazzi. I have received permission to use their names in this document. Here is a brief discussion of each of the subjects. The first CCT is an eighteen-year old female who had a right-hemispheric stroke at age thirteen. She had been studying piano and though she has lost some interest, she has resumed her studies. The second subject Pat Martino is a well known jazz guitarist who had a severe aneurysm in 1980. Though he had considerable memory loss he has utilized his psychological strengths and is again touring and recording. Pat has numerous videos and recordings which will demonstrate his abilities to any interested reader and can document both pre and post trauma abilities. There was also a documentary filmed regarding his trauma as it has impacted his professional career. The third subject SC is a woman who I worked with a few years ago on some musical projects. She, at the time was a successful performer and teacher. SC has suffered two separate traumas to the brain. The first trauma occurred when she was 13 years of age, when she was hit by a car, and the second trauma occurred approximately eight years ago when she was involved in an accident where she was exposed to excessive amounts of carbon monoxide. The fourth subject is JJ who is a professional musician. He has toured extensively with musical theatre companies, as well as a few Broadway shows. The fifth is Ana-Maria Trenchi De Bottazzi who is an internationally known performer and teacher. While on tour in Europe she had a severe automobile accident. After many years of rehabilitation she has recently continued performing in concerts, has written a book regarding her trauma, and is a very successful teacher. In February of 2001 I had the pleasure of attending her 16th Carnegie Hall performance.

Subject number six LH is a professional musician who worked in a factory to supplement his income. While standing on a forklift he slipped off and struck his head on one of the iron bars which extend arm like from the machine. He suffered a skull fracture and is undergoing many types of rehabilitative therapy. LH began working on his CD which was released in the year 2001.

In the cases mentioned above, I have with their consent been in contact with physicians and therapists who have generously given of their time to send me medical documentation

regarding their patients' injuries and post traumatic evaluations. These documents will be combined with data collected in the interviews, the questionnaire, other related documents, and by observation. It should be noted at the outset that some of these subjects limited the amount of material that they were willing to allow me access to. I have described this more fully before each of the sections where the interviews and narratives are found.

It is my hope that a close examination of musicians who have experienced brain trauma may provide proposals for further studies. For example, in my literature review I mention the French physician Alfred Tomatis, who has been a forerunner in the field of audiology and in the importance of the listening process in education. For the last fifty years he has been treating the ear as the primary source of learning. He has had great success with people who he finds have a particular difficulty with the listening process. The trauma may have occurred through various means. Some are traumas are organic, accident, or even have psychological origins. One of his beliefs is that children who have some cognitive or other learning disability i.e. dyslexia, autism, were possibly traumatized in the womb or have suffered a hearing deficit possible by ear infections or other related conditions. Dr. Tomatis, through a complex electronic system and through the filtering of sound stimulates the inner ear muscles which for perhaps reasons unknown have ceased to be sensitive to some harmonic parameters. He has had a wonderful success rate working with these children and adults. Could there be a connection between the system developed by Tomatis, for use in the treatment and rehabilitation of people who have suffered brain trauma? At a later section in this document there will be an exploration of the Tomatis Method and its implications for rehabilitation. We may find through other studies that a musician who has some suffered a traumatic brain injury and developed some form of amusia may be able to be re-educated and this research may be of assistance in his/her rehabilitation. I have approached this thesis then with a particular purpose in mind which is expressed by Strauss and Corbin (1990), "Some areas of study naturally lend themselves more to qualitative types of research, for instance, research that attempts to uncover the nature of persons' experiences with a phenomenon, like illness, religious conversion, or addiction." When dealing with people and illness, I believe that it is imperative to allow the person to offer insights and understandings of their own suffering. In this thesis, I will elicit by qualitatively designed questioning what the

interviewees acknowledge as truth. This in many ways is the "other side of the coin." If we examine the clinical evidence and then support this with an examination of an interviewee's perceptions, a clearer picture will evolve and a deeper understanding will occur.

2 Methodology

Introduction

For the last 25 years I have been a musician/educator and have had professional experience in music performance, memorization, composing, arranging, and teaching music. Each one of these skills/behaviors has given me a new and deeper understanding and a more in depth level of knowledge concerning the thought and motor processes involved in musical performance. Each of these skills requires a different level of memory and experience. This leads to having specialized knowledge about the field of music, memory, and performance that is viable and factual because it has lead me to be successful in this profession. The purpose of the above is not to state I am the only one or the best one with these insights, but that these skills have enabled and empowered me in the fields of music and the education profession. These activities furthermore have led me to develop a certain world view. Every individual develops concepts and perspectives which form a world view based on their experiences and abilities. This is not to say that the view is the same but that the process is similar. As will be discussed in the literature review, experiences lead to a store of knowledge and to memories that help us define new experiences and possibilities.

In developing a methodology for this paper, I propose to use a qualitative approach using semi-structured focused interviews. According to the premise of qualitative research methods:

> "It is the subjective world view of the individual which gives meanings to events and actions. In order to understand how individuals construct reality, it is helpful to understand the everyday routines, interaction so that the problem of how meanings are constructed and how social reality is created out of the interlocked activity of human actors becomes an important and critical topic for examination." (Psathas, 1972)

This study will examine the everyday life of musicians who have experienced traumatic brain injury. It will discuss the ways in which they utilize their musical memory in relationship to performance, overall musical knowledge, and other skills of memory which include not only the long-term process, but short-term as well. A similar paper could have been written by a researcher in another discipline who would look at the same sources from their own perspective and discipline. However, it should be understood that this paper has

been written by a musician/educator and so it should be read with this in mind. Every person possesses a unique perspective in which the views and understandings of the person is stated or implied. In my literature review I will mention the concepts of taken-for-granted and tacit knowledge (procedural knowledge/memory), as these form the basis of many educative and psychological functions. By studying my own background and experiences and by reading the literature, I am bringing to my consciousness the things that I take-for-granted in making music.

My pilot study will assure that my taken-for-granted knowledge does not interfere with the design of this thesis. There are many aspects of music that are taken-for-granted. Pitch identification, reading notes, understanding and responding to dynamics are just a few. The memory skills of musicians and their ability to carry these skills post trauma depends on the level of taken-for-granted before trauma. One cannot memorize something that one can't conceptualize or cannot realize. From this perspective, producing music is not an 'idiot savant' skill. If a person can produce a piece by other means not related to normal music learning it will not be considered a true music learning experience. Cognitive understanding and awareness are necessary prerequisites to music making. An example of this is David Helfgott whose life is portrayed in the movie "Shine." David is able to mimic very complicated musical pieces from classical literature, though he is an 'idiot-savant'. His is a gift of musical mimicry, for he does not possess a genuine understanding of music itself. There was an examination of an autistic savant who was tested by a group in Australia. He possessed perfect pitch and was tested for this ability. Their test consisted of asking him to play two musical selections which were played for him only one time, and which he was not familiar with prior to the test. This savant was able to play these pieces flawlessly (Young and Nettelbeck, 1995).

Another interesting example comes from a book written in 1866 by the French physician Eduoard Seguin entitled, "Idiocy and It's Treatment by the Psychological Method." The subject was a 13 year old male known as 'Blind Tom' who was labeled an "idiot savant" by Seguin. "Blind Tom" was able to play most anything upon one hearing though never having been instructed in music. He however, could not explain what he was doing having no ability whatsoever to be cognizant of his actions. "Blind Tom" also had the ability to play

"Fisher's Hornpipe" with one hand and "Yankee Doodle" with the other, and sing "Dixie" all at the same time. Despite this incredible ability he could not articulate what his actions were, and had could not in any way describe what he was doing. This skill, though quite impressive to the listener is not a true music making experience, in that no cognitive understanding has taking place. In similar fashion it is true that in the animal kingdom certain species are said to "sing," research indicates that it is only human music which "is set into motion by a formal process, itself the result of convention." (Arom, 2000). The ability to nuance or articulate the essence of musical theory with some degree of cognitive understanding is lacking. Therefore there must be a distinction drawn between simple music making and an educated cognitive understanding of music making.

The interview process will be rooted in a qualitative methodology. The idea of this process is that instead of collecting data about people, I will be seeking to learn from them their views of their musical experience and abilities (Spradley, 1979), and not creating a quantitative and direct examination of their brains. Spradley gives excellent suggestions about the questioning process and the analyzation of interviews. The analyzed data though systematically obtained will not be based as some studies are, on a preconceived theoretical framework. Subjects' views of their own experiences create their realities within those experiences. As each case study will be examined individually, I will develop strategies as my relationship with each person develops, based on the predetermined interview structure (Poore, 2000).

To be able to compare the musicians with trauma with 'normals' there was also a pilot study conducted. Through the pilot study I have attempted to illuminate any bias that may exist in my view about the general understanding of how music memory works and is utilized. The subjects used in the pilot study were high school/university aged students and professional musicians. All interviewees have responded to a questionnaire which provided me with background information regarding age, sex, handedness, and length of study among others. The questions asked of each participant are included in the Appendices and are designed to be open-ended, allowing the 'confined freedom' needed for the questions to be asked in a manner comfortable to the interviewee. This interaction between interviewer and interviewee and the inherent flexibility of the semi-structured interview process allowed for occasional

points of departure in conversation not predicted by the interviewer. It is often in this manner that very interesting and important data was allowed to be made manifest. The subjects according to qualitative research must define their 'world view', and so the flow of the interview is dictated by the responses of the interviewee. It is the interviewers task to be sensitive to the nomenclature and world view of the subject and to allow the conversation to unfold in a way that expresses the thoughts and feelings of the subject. Some of the observations of musical elements that I will be looking at during the interview include but are not limited to: body position, hand position, fine motor control, sensitivity to dynamics, pitch recognition (highs and lows), note names, shape recognition, distance, balance, time, note durations, rests, rhythms, clef shapes and meanings, concepts of direction, and ordering, nuance in expression, form, velocity, tempo markings, coordination of limbs, time and key signatures, identifying intervals, chords, and melodies, reconstructing and reproducing melodies, and harmonies, recognizing dissonance and consonance, modality recognition (major, minor, augmented, diminished, half-diminished, suspensions), ability to understand musical ornaments in performance and identify style, recognizing famous melodies, using appropriately musical vocabulary, pattern recognition, cadence patterns, dominant-tonic, resolution patterns, etc.

The main focus of the research will be that of the case study which is a noted, valid, and widely used form of empirical inquiry. This strategy is used when questions of "how" and "why" are being asked, and is especially relevant when the researcher has little control over circumstances, and where behaviours cannot be manipulated. Case studies are also utilized when the investigation is in a real-life setting and is contemporary. All empirical research design is a plan which formulates an investigation into the process of collecting and analyzing the various forms of data.

In my analysis, I will first examine the musical skills prior to trauma. This will be accomplished by using a variety of evidence including; recordings, teachers' interviews, writings, school documents, videos, articles, interviews with relatives, friends, and in the case of the performer, audience members. Observations of the subject and any documentation related to their education in music will also provide the pre-trauma evidence of ability. An analysis of the trauma from a medical point of view will be made. Since I possess limited

medical knowledge, I have requested that a physician be a part of my advisory team. Once the questionnaire is completed, I have created an interactive qualitatively styled set of interview questions for the narrative case studies which can be found in the appendices.

The pilot study and subject interviews were done on an individual basis. For the pilot study thirty possible interviewees were selected by random. A computer program was utilized where the names were randomized. The first six names were then chosen as the subjects in the pilot study. The sample of subjects used will be fully described in the pilot study. As it was most difficult to find musicians who have experienced brain trauma, the requirements were minimal. Some parameters that were considered important were that they will have studied music either privately or at a university, and that there was some brain injury/trauma sustained. Since each study is individual in nature it cannot be representative of any particular population. The questionnaire was filled out prior to the interview. The interview process was completed in one session, and in the actual case study sensitivity to the physical and mental health of the subject was paramount to the time element and dictated procedure. There was some reticence on a few of the subjects as to delving too deeply into their medical condition. These concerns were of course accepted and will be noted as it occurs in the case study analysis. The first part of the interview was an interactively based dialogue. So that there will be a sense of continuity, I have referred back to the interview questions when I noted that the dialogue drifted away from the desired topic. All the interviews were taped and transcribed verbatim. The subjects were aware that they are being taped and it would be unlikely that they have given information that they did not personally believe in, or believe to be true. There are of course inherent in a study of this nature some limitations as well as advantages. One disadvantage is that being tape recorded may make some subjects nervous. I have at every juncture tried to put them at ease early on to make them feel comfortable and avoid tainting data. I tried to be aware of my own taken-for-granted my own views of the subjects' abilities and so there was reliance on verbal data from recordings and, of course, data given by physicians, colleagues and others who have knowledge of them. Word for word transcriptions of the audio tapes will aid with this as well as references to quotes from interviews, data from questionnaires and patient analysis by physicians.

3 Literature Review

3.1 Introduction

This literature review is multi-disciplinary due to the inherent nature of the research as there will be references made to the physiological, psychological, cognitive, educative, and musical aspects of memory. It will provide insight into the focus of my study, which is to delve into the minds of the interviewees and allow them to express what they think is occurring in terms of their musical memory. This part of the thesis then, will examine the many studies that will shed some light on the clinical evidence. Primarily my research will be significant in terms of how these findings relate to the study of memory and will in turn impact other related literature, in that it will provide a different way of looking at the issue of musical memory and brain trauma. This is perhaps a unique view, in that I am most interested in how these musicians view their own understanding of their musical memory. It should be noted that this literature review is written from the perspective of a musician/educator. Therefore, some of the points I make have evolved out of my professional experience and subsequent personal knowledge. However, this knowledge will not be applied in a subjective way thereby colouring the review of literature, data, or analysis of information. Instead it will clearly demonstrate a joining of this expertise with the data and information. In this section then, there will be a look at the literature involved in memory and how this data impacts our understanding of musical memory in terms of anatomy and function.

This section of the thesis then, will examine by way of scholarly research, various models of memory as an introduction and preliminary setting for the interviews and analyses which will follow. The Literature Review will also delve into current research as it relates to the various elements involved in musical memory.

3.2 Questions of Memory

In the study of memory and the human brain, there is an ever increasing amount of experimental research being conducted. Over the last century because many disciplines have studied these topics from a variety of perspectives, there are, unfortunately, many different terms that have been used to identify the same functions. For example, some researchers prefer the term, 'short-term memory' (Parkin, 1987) as a way of describing that aspect of

memory which retains information for a limited amount of time, the data approximating seven digits. Other researchers have used the term 'primary memory' (William James, 1842-1910) to signify the same thing. Still others call it a form of 'working memory' (Baddeley, 1984). The use of such disparate terms can cause confusion and misconceptions within and across the various disciplines. Discrepancies exist within particular disciplines as well.

> "The science of memory continues to be hampered by terminological confusion and excess. The same terms are often used to mean different things. Different terms are often used to mean the same things. Conceptual and theoretical progress would be easier if the use of terminology were to be reformed." (Gardiner & Java,1993)

Many questions have come up over the last few years concerning memory and our understanding of how our brain stores bits of information. For example, where exactly was that childhood phone number stored that I now just happened to remember? Something might have triggered it, but where was it stored? Is it the same location as the phone number I just looked up in the phone directory and dialed? And why was it that particular childhood phone number and not another? Are they stored in similar locations because they are phone numbers or are they stored in different locations because one is long-term and the other short-term? The consensus is of course that there are many places in the brain which store different types of memory that we use on a daily basis such as the sensory memories (touch, smell, and taste) (Desimone, 1992), as well as visual and auditory (Reeves and Wedding, 1994).

Auditory memory will be primarily what this research will address, though other forms of memory will also be discussed. How we process and interpret sound and our use of prior knowledge, the context of the sound itself, and the level of memory skills also will impact the study. While it is well known that the auditory system is functional at birth, maturation of auditory skills is proven to occur as experience, skills, and knowledge increase (Boothroyd, 1997), (Gomes et al., 1999). In fact it has been proved that the auditory apparatus is fully functioning in utero at approximately 4 1/2 weeks gestation (Campbell, 1997 p.18). This sensory processing in humans allows a new aural stimulus to create an environment where memory of past aural events are remembered, compared to the new stimulus, and new neural circuits are created (Alain et al. 1998). Research has demonstrated that neural activity and growth occurs through any kind of modality and stimulus, but there is also the possibility that some processes can lead to the creation of memories that are not accurate. This occurred in a

study where tests were conducted on the recall of theme related words (Toglia et al., 1999). Other studies on autobiographical memory found some memories to be most subjective as well.

There are also the automatic motor activities which are "tacit" skills known in psychological circles as procedural memory. For instance, one does not have to think about how to balance while riding a bicycle, or how to use one's legs when walking, or the myriad of other relatively complex motor activities that are part of tacit knowledge. Though these skills were once learned and practiced, they are now a part of the automatic. Tacit knowledge therefore is knowledge which is unconscious. It was learned at one time, but now is automatic (Polanyi, 1962). Unlike taken-for-granted knowledge, tacit knowledge is not recallable in a cognitive sense. Musicians, use a multitude of motor skills when playing an instrument. The fine motor skills of a clarinetist, for example, must be very accurate to perform even the least intricate of pieces. Even non-motor skills like those related to the recognition of melodic and harmonic structures were found to be a tacit knowledge in trained musicians (Holleran et al., 1995). Many of these skills become automatic or "taken-for-granted." Cognitively speaking once these skills become tacit knowledge the performer can memorize a piece and perform the skills in "automatic drive." This concept will play an important part of the strategies utilized by the interviewees in describing some avenues of musical memory. Kinesthetic memory is used by most musicians as a means of support for visual and auditory memory systems. The difference between the performance of memorized music and tacitly known behaviors, is that in performing memorized music one can revert back to the cognitive knowledge that one has taken for granted in obtaining a tacit ability. Taken-for-granted motions then, are those skills and actions which can be articulated. This type of knowledge rests on assumption and is recallable when needed. There is much to be learned about taken-for-granted knowledge by removing an anticipated behavior and observing the results (Garfinkel, 1972). As an example, if one were to hold up an envelope and then ask someone to identify it and describe its uses, some responses might be that it is a particular colour, it is used for the mailing of communications, or filing of some documentation. If before the demonstration one were to cut the bottom, so that the opening was not discernible, and then attempt to place a letter in it, it would fall to the floor. It was taken-for-granted that the envelope was intact.

When emotions are factored in, such as fear or anxiety, a musical performance may involve errors that may not have occurred had these emotions not surfaced. In Wilson (1991) a simple task in a performance setting can trigger an upset in the timing and motor skills of a trained professional. The example is given of how in the second movement of Bruckner's Seventh Symphony there is only one cymbal crash which must be played precisely. The player inevitably begins to exhibit visible signs of anxiety as the time for this one note approaches. If, however, there were many cymbal crashes in a piece, the musician's anxiety would diminish, but in the Bruckner there is a slight misapprehension and tension noted in the motor skills of the player.

3.3 Models of Memory

Procedural memory (Moscovitch, 1982) controls the ability to remember what has been learned through the environment. When the organism responds to a stimulus and retains this communicative event, it is utilizing procedural memory. This element of long-term memory is the information that is automatic or tacit and cannot be examined. It can however be demonstrated by the involved complex skills like running or riding a bicycle. These types of skills are instinctive in their makeup, and so when asked to describe them, we find that they are not so easily broken down into identifiable, understandable units. Additionally, there are many conscious behaviours at work in this process. They will provide the framework for future behaviours, but will do so without any conceptualization of past events. Researchers have examined those patients with prefrontal lesions and have observed that they have procedural memory difficulties (Gomez -Beldarrain et al., 1999). In this study there appears to be a direct correlation between this anatomical area and this particular form of memory function. This model of memory will react to stimulation no matter what the source, though it usually refers to sensory stimuli. Procedural memory can be assessed in a variety of ways. The usual form is to be tested by presenting some task or action for the subject to do. Then after some time and with practice, they are retested to see if any improvement has taken place. These types of tests primarily test motor skills, or some other form of cognitive process.

Semantic memory (Baddeley, 1984) represents what we know of the world and creates through its processing, complex models and systems. Semantic memory remembers facts, rules, ideas and other cognitive elements. Speech functions, motor skills, and perceptual

events are included in this process. Many types of aphasias are, in reality, a loss of semantic memory due to damage to the language regions of the brain. Semantic memory interestingly enough cannot operate independently of procedural memory, simply because although it can create a model of the world, it cannot appreciate actions related to the model. A person's world view which is self-conceptualized exists primarily due to semantic memory.

Episodic memory (Tulving, 1985) is that system of memory which allows us to go back in time and re-experience events and reformulate the acquisition of knowledge. It is temporal in nature. Episodic memory relies heavily on both procedural memory and semantic memory and involves identification with subjective personal events and their relationship in terms of time and space. This form of memory can be damaged without affecting procedural or semantic memory systems. Anatomical studies in fact have indicated that certain areas of the cortex yield higher success rates in episodic retrieval (Buckner et al., 1998), (Donaldson and Rugg, 1999). One particular study specifically points to the role of the left prefrontal cortex, which associates memory encoding with this area of the brain (Fletcher et al. 1998). Episodic memory can retrieve information regarding the past and isolate specific memories as in visual images, and auditory memories (Buckner et al. 1996). This form of memory is an important element as we examine the interviewee's responses to their utilization of musical memory. Though it is not known exactly how this specialized memory is accomplished, organized or retrieved, it is believed that events are used as identifiers which the episodic memory recalls, and then associates and relates these to other events. In this way, events are placed in a form of time-line upon which events can be sequenced, identified, and encoded. Researchers tell us that while some memories are vividly remembered in the context of time and place others may only give a general sense of familiarity. The importance and relevance of the even plays an important part in which memories are vivid or not. It was found in a recent study that the hippocampus was directly related to the support of episodic memories but not those of a vague nature (Eldridge et al., 2000). Positron Emission Tomography (PET) and fMRI (functional Magnetic Resonance Imaging) adds new insights and understanding into the where and how of human memory are being found (Buckner et al., 1998). Most researchers accept the memories as valid, however the authors of a recent study suggest that episodic and semantic memories are not specific enough and should be tempered with the distinction of

whether or not the memory of events is personally relevant or not (Maguire and Mummery, 1999).

Short-term memory skills and its ability to store material are considered by many to be the most important skill a person can possess. For instance when reading, in order to comprehend what one is reading fully, a person has to remember the beginning of the sentence when reaching the end, otherwise the meaning of the sentence will not be understood. When reading music, the musician is utilizing his short-term memory skills much the same way as we process language (Clarke, 1989). The musician must remember notes preceding his current playing, and he reads ahead so as to anticipate the notes that are forthcoming. Research indicates that there is not as clear an understanding of where the localization center of reading and writing music is found, when compared to the body of research concerning the localization for reading and writing language. A recent study did attempt to identify the cerebral localization for reading and writing music, when a professional trombonist suffered a hemorrhage in the region of the left angular gyrus during a rehearsal just prior to a concert performance (Kawamura, Midorikawa, and Kezuka 2000). The test completed on this musician demonstrated that there was some alexia with agraphia for language and music, thus implicating this area as a point of localization for this function. Other research has indicated that damage to the left upper parietal lobe also has been implicated in causing both agraphia and musical agraphia (Midorikawa and Kawamura, 2000), (Paolino et al., 1983).

In a study of the musical reading process, eye movements were examined in musicians who were playing specified rhythms (Kinsler and Carpenter, 1995). The measuring of this type of data can occur in one of two ways. The first is the note-index which measures the number of notes between hand and eye, and the time index which measures the length of time between the reading of the notes and the performance (Furneaux and Land, 1999). This short-term storage is usually tested and measured in terms of digits (Parkin, 1987), usually by asking the subject to repeat back randomly ordered numbers. It has been demonstrated that for most people this span is approximately seven digits, plus or minus two (Miller, 1956), (Glassman et al. 1998). Another element to the short-term memory system is that of "chunking." Chunking occurs when certain patterns evolve that can be identified and unified. In other words if the first four digits that I am asked to recall were 1477, I can perhaps relate this to a year in which

something historically occurred, thereby utilizing the four digits as one. This occurs a great deal in the musical memory process, as we will see. This is a strategy that some of the interviewees utilized as a means of memorizing particular passages of music. If there is for instance, a particular chord progression, instead of memorizing each chord individually, the musician may organize the information in a pattern that is more easily remembered.

In some contemporary literature, it should be noted that the term "working memory" is a more current and popular term that can also be used synonymously with short-term memory. According to Baddeley working memory is divided into three components:

> "(i) the central executive, which is assumed to be an attentional-controlling system, is important in skills such as chess playing and is particularly susceptible to the effects of Alzheimer's disease; and two slave systems, namely (ii) the visuospatial sketch pad, which manipulates visual images and (iii) the phonological loop, which stores and rehearses speech-based information and is necessary for the acquisition of both native and second-language vocabulary." (Baddeley, 1992)

The phonological loop has two separate components, the phonological store and the articulatory control process. For the disabled reader when compared to the more skilled reader, it was found that the learning disabled reader had difficulty with the phonological loop in terms of reading comprehension and executive processing problems. This however, was not related to reading comprehension component (Swanson, 1999). It appears that for reading comprehension and decoding skills, children with poor comprehending skills also have poor recall of abstract words, yet showed normal difficulties with manipulations. This was interpreted as the child having more of a difficulty with memory and language impairment rather than reading comprehension failure (Nation et al. 1999). There is evidence that the phonological loop is integral in the learning and formulation of new words, and is therefore used primarily as the storage place of sound patterns that have been recently introduced (Martin-Loeches et al., 1997), (Baddeley et al., 1998 January). The phonological loop also appears to process music according to Sharps and Pollitt (1998). This does fall into line with some literature that suggests that there is some connection between the processing of language and music. The central executive which is activated in the prefrontal cortex, was found that its functions also occur in the anterior, posterior, and parietal areas of the brain as well (Collette et al., 1999). One study explains that this understanding of the physiological aspects of

working memory studied by many researchers has not yet been explained by its limited capacity for information retrieval however (Callicott et al. 1999).

For the elderly, normal age deficits are noted in terms of working memory and the central executive, but not in the functioning of the phonological loop (Fisk and Warr, 1996). Information in this form of memory model is easily lost by the natural process of forgetting or non-use, the problem of distraction, and of non-rehearsal. There have been many studies whose results demonstrate the factors which cause short-term memory to be interfered with. It would appear that the only way to utilize short-term memory to its fullest is by way of rehearsal. This holds true for silent rehearsal as well as oral rehearsal. One subject who possesses superior musical memory skills explains that for her, rehearsal is paramount. She explained that if there was a need to remember something of importance, like picking up the mail to bring to the post office, she would mentally envision herself doing this four or five times.

According to the literature, the short-term auditory store is approximately seven digits (plus or minus two). For music, it appears that its capacity is between 11 and 15 pitches (Long, 1977; Dowling, 1991). Melodic lines appear to be able to be chunked and remembered relatively easily as in the processing of language. If I can relate and chunk the melody by way of timbre, melodic contour, or some other method the success rate increases. One study explores the idea that each item in working memory is expressed by specific brain wave frequency (Glassman, 1999). In another more recent study it appeared that when musicians were listening to music there was significant activity in the gamma frequency range (30-50 Hz) compared with non-musicians (Bhattacharya and Petsche, 2001). The same study came to the conclusion that there was a left hemispheric dominance for musicians listening to music while the right hemisphere appeared to be dominant for non-musicians for text. Therefore this might provide further avenues of a correspondence for understanding the neural aspects of working memory through the mathematics of music.

Through the use of non-invasive neuroimaging techniques, a more accurate understanding of how and where the brain utilizes the information it receives is being studied including the system of working memory and its relation to the prefrontal cortex (Courtney et al., 1998), (Wildgruber et al., 1999). Recent studies have attempted to identify regions of the

brain which are associated with different forms of memory. A synthesis of these findings appears in a journal article by Cabeza and Nyberg (2000). Working memory, which according to recent research is negotiated in the frontal lobes, houses short-term storage and the executive processes which analyze the data received (Smith and Jonides, 1999), (Rypma et al., 1999). This information does not address however whether this processing involves both spatial and non-spatial working memory. A study found that the brain differentiates between the types of processing as compared to the nature of the information being processed (Owen et al., 1999). In terms of coherence it was found that the prefrontal cortex initiates and synchronizes with the posterior cortex (Sarnthein et al., 1998).

The cortex of the frontal lobe assists in the organization of the neurobiological and cognitive domains. Lesions in this area can lead to disorders in thinking and the spoken language (Fuster, 1999), and even with the understanding and the appreciation of humour (Shammi and Stuss, 1999).

Researchers have come to the conclusion that there are two basic reasons why our long-term memory skills become weakened. There may possibly be some dysfunction in the transfer of information from our short-term memory to our long-term memory. This, for obvious reasons, has been difficult to empirically prove. A much more recognized and accepted explanation is that our retrieval process can break down. The retrieval process in our long-term memory is most sensitive to and influenced greatly by outside stimuli and interference. The psychological state of the person has much to do with the retrieval process. It has been shown that a person, for instance, in a state of depression remembers less. It may be that forgetting is a condition that circumvents our normal retrieval processes, or that the memory of the event is actually gone. Perhaps the memory of an event just needs to be triggered by some emotion or other related memory whether it be visual, auditory or any other sensory memory. Studies in this field indicate that not all past experiences are stored and retrievable. It was found by Loftus and Loftus (1980) that long-term memory is not permanent. As new memories are formed, pre-existing memories are changed and restructured to include these new structures. Our memories are in reality forever changing as these new bits of information are processed, digested, and nuanced by the brain. New neural networks are built, and relationships with other memories are made. This encoding process

identifies the new stimuli, and depending on the accuracy and context of the already existing memories, retrieval probability increases. The neurons involved in the long-term memory process appear to sustain the fundamental data of a memory even well after the conscious mind has apparently forgotten it.

As stated above the two subsystems of long-term memory which have gained much popularity recently are the semantic and episodic memory systems. However, there are also two learning systems associated with long-term memory which are known as procedural and declarative (Parkin, 1987; Crowder, 1993). As discussed before, procedural memory consists of motor skills, as in riding a bicycle or playing the piano, whereas declarative memory are memories of facts or events. Recent findings indicate that procedural memory/learning is found in the neural circuits in and around the prefrontal cortex (Gomez Beldarrain, et al. 1999), and that it is especially important with the involvement of the corpus callosum in the procedural learning of a visuomotor skill (de Guise, et al 1999). Studies have been done to evaluate the effect of age on free recall. One study found a decline in memory ability and in conceptual processing in older age groups (Sauzeon, et al, 2000). This particular study examined various influencing factors on memory such as degree of effort, encoding skills, and retrieval support. The semantic/episodic models it should be noted though similar in many respects are more theoretical in nature.

On a more practical level, two systems of thought have developed, which are termed prospective and autobiographical memory (Conway & Rubin, 1993). Prospective memory involves the remembrance of things which need to be accomplished in our daily lives. It is a way of defining our priorities and how we organize our lives. It is the type of memory that one is usually referring to when they say that they have a terrible memory. Where one has placed their keys, forgetting an anniversary etc., are common forms of prospective memory. Autobiographical memory produces the ability to remember events in one's life even back to childhood (Pillemer, 1998). It is in autobiographical memory where places, emotions, and other items relating to one's image of self is manifest. Researchers typically claim that this form of memory has three components; lifetime periods, general events, and event specific knowledge. Each component has specific areas of concentration. In lifetime periods, themes relating to one's life may surface and can include moods, goals, and people who played

significantly in these memories. General events are those which may not bring up specific occasions for remembrance, but less defined images like 'enjoying the opera', or 'driving in the country.' It is more defined and organized by the context of the event rather than the event itself. These memories are akin to short autobiographical personal histories. Events which have been experienced for the first time are included in the general event memory. The first time away at college or the first time you flew a plane would be a part of this form of memory. Event specific knowledge is an extremely detailed aspect of autobiographical memory and studies have indicated that it is early adulthood which produces the most vivid autobiographical memories (Rubin et al., 1998). This part of memory holds the specific images, details of action, objects, and feelings of past events. These events can be clouded over by misperceptions and a variety of psychologically induced stimuli which can create a faulty subjective sense of actual detail. In Johnson et al., (1988) it was found that there sometimes appeared a reality based problem in which perceived events were given higher ratings than imagined events. Memories are sometimes inaccurate as people co-create remembrances from general knowledge, previously learned information, and whatever the situation might be which triggered this memory (Hyman and Loftus, 1998). It was noted in Kris (1975) that when subjects were probed concerning past events, they were able to recall in detail an incredible amount of autobiographical information. A study was done to see if there were any gender differences in autobiographical memory for traumatic childhood experiences. This study indicated that females remembered these childhood memories more quickly and in greater number (Davis, 1999). This was found to be unusual due to the findings of previously completed studies. From a psychological perspective, the realization occurred that it was actually the process of repression at work which was employed to keep traumatic experiences from coming to consciousness. It was found that depressed people for instance, had difficulty when asked to retrieve specific autobiographical memories which were even distantly related to the cause of their depression (Kaney, Bowen-Jones, Bentall, 1999). In the elderly and their ability to remember autobiographical events testing revealed that aging appeared to effect episodic memory more than semantic (Rybash and Monaghan, 1999).

3.4 Neurological Perspectives

Modern neurology and its study of memory had its initial beginnings in the latter part of the 1800's, where European physicians began to develop research strategies in order to try and identify specific brain function and localization. What fascinated these neuroscientists was the fact that it was becoming abundantly clear that different parts of the brain stored different elements of memory. Primarily through the study of damaged brains, neuroanatomical studies, surgical procedures, and animal research, the focus began to evolve out of two diametrically opposing points of view. Some felt that the different anatomical parts of the brain held specific thoughts or memories. Others thought that the brain is only a single entity or unit and does not operate different functions from different regions. The current understanding is that both camps had some truth in them in that the brain is organized in both a unified and diffuse way, which depends primarily on the functions being deployed. Some functions utilize very specific areas of the brain while others involve multiple regions (Leask & Crow, 1997). Some aspects of localization are still not fully understood, though a few have been identified. For instance visual perception is known to be housed in the rear of each hemisphere in the occipital lobe which is the center of our visual perception system (Springer & Deutsch, 1981). There does not appear to be a formal related anatomical region for vision.

In these early studies the complexity of memory intrigued those in the psychological, the anatomical, and the biochemical fields, among others, and various types of brain trauma were explored and examined. Some trauma was due to injury (closed head injury or penetrated), others occurred in normal aging processes, and still others from vascular difficulties, which can happen either from physical degenerative disease or from substance abuse. In Germany especially, there became a somewhat widespread examination of musical dysfunction in patients with brain disease. The look into musical disorders began with a study of aphasic patients, because at the time the literature was revealing similarities in the processing of music and language. The finding was that some of the patients in addition to being aphasic also lost some musical skills in the process. The skills which are the basis of musical ability are a sense of rhythm, sound, which includes pitch, intensity, duration, and timbre, and the expressive elements which indicates an ability to interpret, and compose. A case of a musician was examined who suffered a left hemispheric stroke and who became

aphasic as well as amusic. The defects in both language and music were similar in terms of production of sound (Hofman et al. 1993) and these similarities lead many to come to the conclusion that language and music do indeed share similar memory areas but in opposite hemispheres (Tervaniemi, 1999).

As stated before there has always been some correlation in the brain between language and music. In November of 1998 in Los Angeles, California there was a presentation at a meeting of the Society for Neuroscience. At this meeting the researchers attempted to explain what the neural inferences are concerning the comprehension of musical elements. Through the use of non-invasive imaging techniques these researchers found that musicians use interconnected brain areas when various aspects of music are being listened to critically. In the right hemisphere where music is interpreted, there is a connectedness and corresponding location in the left hemisphere for interpretation of words. This study also concluded that musical concepts are widely dispersed rather than localized in a single region like vision or hearing (Liegeois-Chauvel et al., 1998). The researchers also were able to conclude that the way in which people utilize the structures of music and the structures of language appeared to be similar. The right hemisphere houses musical interpretation of notes and musical passages i.e. melodies and harmony, directly corresponds to the left hemispheres housing of letters and words. There may be the possibility that there is a similar neural strategy or system which is equally present in both hemispheres. This may indicate that each of the two hemispheres becomes a specialist in the adaptation of information as it relates to its individual purpose.

3.5 Physiology of Memory

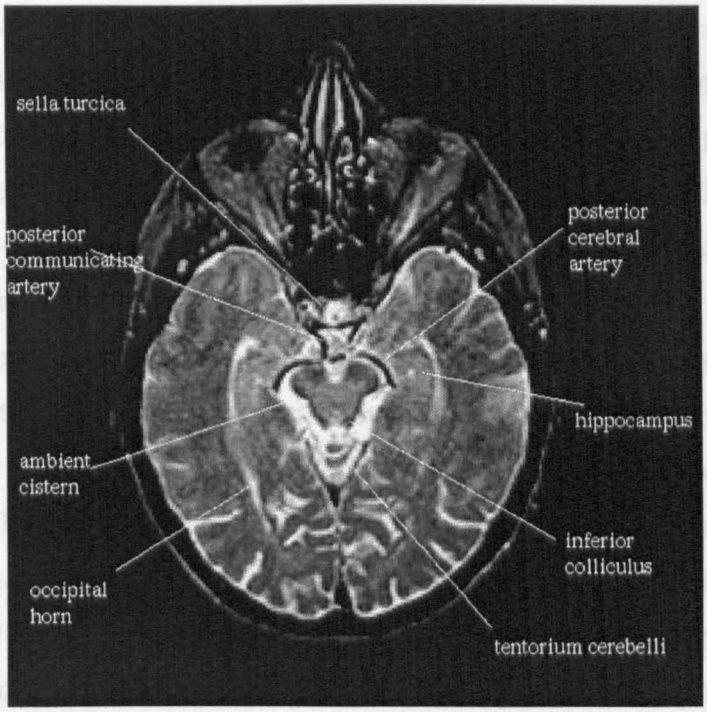

Figure 1 An MRI of the brain including the area of the hippocampus

Recent research has documented suspected finding of the role of the hippocampus in memory functions in humans. The following relates in what way certain anatomical areas were found to have a direct association to certain memory functions described in previous paragraphs. It is well documented that the hippocampus is involved in associative learning and memory (Wallenstein et al. 1998), as well as long-term storage (Lopez-Garcia, 1998) and in the formation of new memories (Parkin, 1996). The hippocampus is also believed to be active in all language tasks whether they be simple or complex (Brockway et al., 1997). The physiological aspects of long-term memory begin with proteins and their effects on genes which may in turn effect memory storage (Abel & Kandel, 1998). Studies have shown a correlation with human memory and animal memory especially with motor skills found in procedural memory (Brozek, 1997). The hippocampus was found to be involved in long-term declarative memory, encoding and in word recall (Alkire et al., 1995) whereas the amygdala is also involved in declarative memory when vivid emotional events are recalled (Cahill and McGaugh, 1998, July). In several studies it was found in rats that in terms of spatial memory,

it was the dorsal, not the ventral hippocampus which played an important part (Hock and Bunsey, 1998). Long-term memory appears to be retrieved by hippocampal cells which were activated when testing occurred pharmacologically (Arkhipov, 1998). In terms of overall differences in declarative versus procedural it was noted that the hippocampal region was involved in declarative memory while the caudate nucleus was involved in procedural memory (Squire, 1998). Declarative memory because of its personal dimension of facts and events is emotional in nature (Cahill and McGaugh, 1998). For some time the amygdala was thought to be the site of declarative memory but recent findings indicate that it acts to influence other regions like the hippocampus. In terms of understanding lesions in the hippocampal region, it has been suggested that there was a difference found if the lesion is dorsal (upper) or ventral (lower). This is true especially in spatial memory in which the dorsal hippocampal has proven to be more affected by this type of lesion (Hock and Bunsey, 1998), (Long and Kesner, 1998).

A longitudinal neuropsychological study of a patient who had bilateral atrophy of the hippocampal formation which resulted from poisoning by carbon monoxide. It should be noted here that one of the subjects SC, also was poisoned by exposure to carbon monoxide and was found to have severe memory difficulties. For patients with a reduction of the hippocampal formation resulted in severe global amnesia. Eventually in this study there was a gradual recovery of some episodic memory functions occurred, though other functions remain impaired (Henke, et al. 1999).

There is an increasing amount of literature on the importance of laterality. Hannaford (1997) among others suggest that knowing laterality, or as she terms it, dominance profiles, will assist in the process of education. But how does that fit in with music? The issue of laterality is most important to brain research as it attempts to explore empirical data suggesting particular areas of involvement for specific function. Once a clear distinction can be made with regard to where localization of function can be found this information will impact nearly every discipline. Does the literature offer any insights into anything more specific concerning music and hemisphericity? As in many disciplines there have been arguments for various positions throughout the years. At first light, musical abilities were thought to be only a part of the left hemisphere, then a few years later in the right. A more current understanding is that in a sense both positions were correct due to the fact that trauma to either side of the brain can

induce some form of amusia (Peretz, 1985). Melodic forms of amusia appear in right hemispheric damage while rhythm is affected in left hemispheric damage. In the realm of auditory perception and processing it has been observed that when there is unilateral damage to the brain, the ability to hear and understand music may remain unaffected yet the patient may have difficulty in the perception of voice (Roeser & Daly, 1974). Many studies on musical processing in musicians found that there was a left hemispheric dominance when listening analytically to music, though these findings are not totally consistent or conclusive (Vollmer-Haase et al., 1998), (Altenmuller, 1986), (Tasaki, 1982).

In analyzing melodic structure the left-hemisphere was shown to be involved in the ascertaining of intervals, while the right-hemisphere used a melodic contour approach (Peretz and Babai, 1992). A study reaffirmed these findings and further noted that there was a most definite left-ear/right hemispheric advantage in terms of melodic contour (McKinnon & Schellenberg, 1997). Emotional qualities of music were found to have a left-ear advantage (Bryden et al. 1982) though a more recent study qualified this and claims that the left hemisphere possesses a proclivity towards positive emotions while the right possesses a proclivity to negative emotions (Gagoon and Peretz, 2000). The most recent research regarding this was a study by Altenmueller (2002), which examined students who were exposed to 160 musical pieces from a variety of styles. Emotional valence was rated after each piece. The results upheld previous positions that "positive emotional attributions were accompanied by an increase in left temporal activation, negative by a more bilateral pattern with preponderance of the right fronto-temporal cortex." Panksepp and Bernatizky (2002) have taken this one step further, discussing how music may foster behavioural changes. They have also included possible medical-therapeutic strategies for the use of music and brain emotional systems.

Other studies indicate the importance of the right hemisphere in musical processing (Kester et al. 1991), especially the perception of harmony (Tramo and Bharucha, 1991), (Preisler et al. 1989). However, when there was found to be trauma to the right hemisphere one study found that only rhythmic sense was disturbed (Fries and Swihart, 1990). Aging appears to effect changes in dichotic testing in the right hemisphere and not the left (Johnson et al. 1984). Another study suggests based on the use of neuroimaging methods that there is

an overall right hemispheric dominance for non-musicians and left hemispheric dominance for musicians (Evers et al., 1999), (Larmande et al., 1984), (Johnson, 1977).

There are apparently some differences found between those trained in music and those who were not. What then are the differences? If education and training change the way we perceive music, in what way is this accomplished? When looking at the anatomical suggestions for trained musicians, it was found that in the left hemisphere the tasks of melodic familiarity, pitch, and rhythm were activated whereas in the right hemisphere timbre was located (Platel et al., 1997). Even with reference to tempo, when comparing musicians to non-musicians it was noted that even though aging may affect encoding processes, the musicians with their expertise remained more able to identify familiar melodies that were played at varying speeds (Andrews et al. 1998). How the brain interprets auditory stimuli in terms of dichotic listening tasks has led to many interesting studies. One such study examined the perception of digits, melodies, and chords in college age musicians. These students were presented with auditory stimuli presented in both ears at the same time. The results were that the "left ear showed a significant superiority over the right in recognizing chords..." (Gordon, 1970). Another study found that the left ear performed better than the right in sequences of melodic contour. The conclusion drawn was that the right-hemisphere is utilized for the processing of melodic contour (McKinnon and Schellenberg, 1997). A non-dichotic study was also conducted regarding whether or not listeners can discriminate among major chord positions. It was found that the listeners were able in fact to discern the difference between chord positions, however these findings led to the conclusion that it was not a perceptual discrimination but a cognitive one (Hubbard, 1998). Another dichotic listening study looked at lateralization when amplitude and frequency of the tones were varied (Deutsch, 1988). The findings indicated that when the amplitude was the same in both ears, lateralization was favored in the ear, which received the frequency that was higher. The laterality of melody and timbre were examined in this study where 64 right-handed non-musicians were examined (Boucher & Bryden, 1997). It was found that the laterality for melody is independent of the laterality for timbre. In addition females were more accurate in melodic recognition in the left ear but no difference in gender advantage was found in timbre recognition. However, when tested independently of melody, timbre of instrumental sounds appeared to be lateralized in

the right-hemisphere with a very definite left-ear advantage (Paquette & Peretz, 1997), although in one study, left-handed people showed that they had better pitch memory than the right-handed (Deutsch, 1978). The above studies were of a receptive nature, so what was found regarding the expressive dimension and the possibility of gender differences? The study in which they examined cerebral organization of speech and vocal exercise, found that the females tested varied less in their performance than males, though in both groups bilateral integration was noticed (Hough et al., 1994). In language both genders were found to be left lateralized in a recent test using MRI (Frost et al. 1999).

The studies mentioned above relate findings, which demonstrate what happens under varied circumstances inside the brain. However, before this can occur a sense of how we utilize auditory perception needs to be examined. What of musicians and their unique understanding of musical elements? Is there a difference in how a trained musician utilizes his dominant hemisphere? Once the knowledge is attained that there are benefits to knowing brain dominance, how does this impact a musician's way of looking at memory? A study of hemispheric dominance was completed using a transcranial Doppler sonography. These professional musicians who were all members of either a choir or an orchestra were tested for hemispheric dominance while listening to Bach fugues performed instrumentally and a-cappella (Vollmer-Haase et al. 1998). While most of the studies of musicians tested for musical processing demonstrated a left hemispheric dominance, many researchers felt that this was due to a more analytical posture. There were two phases of this study, one passive and one where fugal themes were asked to be recognized. During passive listening the choral listening showed a weak left-dominant blood flow acceleration. There was none during the instrumental version. The active listening example where recognition of fugal themes were requested, there was a demonstrated high increase in favour of the right sided blood flow in both musical versions. The conclusion drawn was that in the analysis of melodic contour a right hemispheric dominance is observed in musicians.

3.6 Aphasia and Amusia

The term 'amusia' was coined during an active time in the annals of brain research and was coined by the German physician Steinhals in 1871. The term amusia was used to denote some disability for musicality and/or musical comprehension. At this point in time the term

was employed quite loosely and had not yet been medically or psychologically defined. There were two types of amusia noted in the literature of this period. The first was sensory amusia, which was used to describe a patient's inability to understand, appreciate, read, or even to hear music. The second type concerned itself with motor skills and therefore aligned itself with the performance or expressive aspect of music. Recent findings suggest that as it relates to performance, it is the motor cortex which contributes to learning and memory of muscle motor skills (Sanes, 2000) including the movements of professional pianists (Jancke et al. 2000). This expressive form of amusia created in the patient can be an inability to play an instrument, write, or sing even though excellent prior skills existed. As found with aphasia there is a direct correlation between the site of the diseased tissue or lesion and the type of amusia (Berman 1981). With regards to musical agnosia it was found that apperceptive agnosia occurs from damage to structures in the right hemisphere, while associative agnosia occurs from damage to structures in the left hemisphere (Ayotte et al., 2000).

The physicians at this time began to experiment with the relationship between the outward and apparent musical dysfunctions and associate it with the anatomical changes in tissue of the brain i.e. lesions, diseased matter, etc. (Wertheim, 1977; Peretz, 1990; Griffiths et al.,1997). Upon further reflection the term amusia began to evolve in a more substantial way due to the diligence of scholars and researchers. Other defined forms of amusia now began to appear in the literature (Benton, 1977). In the study of the disability of motor function, there appeared references to oral-expressive amusia (the inability to sing), musical apraxia (the inability to play an instrument), and musical agraphia (the inability to write music) (Takeda, Bandou, and Nishimura, 1990) (McFarland, and Fortin, 1982). Some of these unfortunate conditions are degenerative and progressive in nature (Confavreux et al. 1992). As music is a cyclic discipline of give and take, there were also noted receptive musical disorders, i.e. musical alexia (the inability to read music), and sensory amusia (the inability to appreciate and understand melodies) (Schuppert et al 2000).

There is recent evidence that supports the concept the music has a biological basis in the brain. This view was formulated by a study in which patients were found to be amusic from birth (Stewart and Walsh, (2002). The first documented case of congenital amusia was a woman known as Monica, who does not possess most musical abilities. This means that her

amusia did not occur by any condition, disease, or lesion after birth. This adds to the evidence that it appears that musical ability resides in the brain from birth (Peretz et al. 2002).

Because of the apparent similarity of function, additional comparisons began to be made between aphasia and amusia. Indeed there has been much written regarding the connectedness of language and music (Bernstein, 1977; Aiello, 1994; Patel et al, 1998). Though at first amusia took on the same understanding as that of aphasia, which was considered to be a dysfunction that affected either the motor or sensory regions in the brain. Eventually these were subdivided into what the amusia affected, i.e. rhythm, melody. The evidence began to mount as laterality began to take shape as patients with brain lesions were tested and conclusions drawn as to the localization of function. (Benton, 1977). Findings were clearer as more data and cases were known and demonstrated that the presence of aphasia does not always indicate the presence of amusia. For instance musical alexia was found in a female pianist of Japanese descent who suffered an intracerebral hematoma which was operated on. After her surgery it was found that her auditory recognition of music was still intact as was her abilities to sing, play melodies and take musical dictation. Her initial problem of musical alexia was still prevalent however as difficulty still remained when reading written music. It is interesting to note that her ability to read rhythms was still good (Horikoshi et al. 1997). While the previous case occurred in a professional musician, there is a case presented in a male non-professional musician who suffered a lesion in the left superior temporal gyrus. This 20 year old who is left handed possessed normal processing of speech and environmental sounds, but demonstrated impairment of music abilities including expressive and receptive melodic sequences while expressive and receptive rhythm patterns remained intact. The conclusion drawn was that amusia may be produced by a unilateral lesion, and that the superior temporal gyrus is crucial in the processing of melodies (Piccirilli, Sciarma, and Luzzi, 2000).

The relationship that was noted between music and language primarily exists because both modalities are auditory and acoustical processes. In both music and language information is processed by the brain in structures, i.e. words becoming a sentence, pitches becoming a melody. Although there is much evidence that there may be some overlap between aphasia and amusia (Damasio and Damasio 1977), (Zatorre, 1984), one dysfunction

can occur without the other, as in the case of I.R. who suffered bilateral damage to the temporal lobes as a condition resulting from brain surgery. She had severe amusia being unable to recognize instrumental and vocal timbre and was not able to sing at all (Peretz, Belleville, and Fontaine, 1997). This of course is dependent on the location and severity of the trauma and the pre-existing special skills of the patient. There are also examples of cases where some trauma has caused both expressive and receptive amusia (Mavlov, 1980). In this case it was a left hemispheric vascular stroke in a professional musician which left him unable to recognize and duplicate simple rhythmic patterns while it left his recognition of tone sequences intact.

In studies of music and language and their parallel relationship to memory function, an examination of two musicians were undertaken, both of which had a form of degenerative brain disease (Polk & Kertesz, 1993). Both musicians were given standardized language batteries, and a series of tests which measured their abilities in music. The first suffered left cortical atrophy. He became aphasic, and was severely deficient in language comprehension skills. His musical skills however, were not as badly affected and were considered by the examiners to be of an adequate nature. The second suffered posterior cortical atrophy on the right side. She appeared to be non-aphasic by her demonstration of excellent articulation and language comprehension skills. Her musical abilities however were deemed not adequate. All elements of music were deficient in nature as was her inability to play the piano. While the findings in the analysis of these two musicians follow and support other research indicating basic hemispheric dominance, it also raised some important questions. These questions could very well be inherent in the nature of the degenerative aspect of the patients' conditions. A degenerative condition cannot be approached as if it were a lesion or tumour which more often then not will leave the patient in a stable condition as it in turn stabilizes, but will over time leave the patient in a worsening condition.

A very interesting study examined whether or not there was increased gray matter density specifically in Broca's area due to the influence of music (Sluming, et al. 2002). It is now known that Broca's area is an anatomical area that is an essential part for spoken language and some musical abilities. Using various tests they examined male orchestral musicians and non-musicians. The suggestion drawn from the conclusion of the study is that

"orchestral musical performance promotes use-dependent retention, and possible expansion, of gray matter involving Broca's area and that this provides further support for shared neural substrates underpinning expressive output in music and language."

3.7 Musical Memory

An good way of approaching the understanding of musical memory is to test both musicians and non-musicians. Testing both musicians and non-musicians will demonstrate similar strategies that both may utilize, but more importantly it will also clearly show how trained musicians use their musical expertise. It should be noted at the outset before I discuss the differences between musicians and non-musicians, recent literature has demonstrated that there is a strong reason to believe that there is an implicit musical ability of the human brain for music even in the non-musician (Koelsch et al., 2000). In a previous section I present research regarding studies that indicate that there is strong evidence to conclude that there is a biological basis for music in the brain. This evidence comes primarily from examining people who have congenital amusia (Ayotte et al. 2002; Stewart and Walsh, 2002). I think it quite natural to assume that musicians will undoubtedly make use of their musical knowledge. For instance a musician will possess greater pitch and melodic recognition primarily because this is the medium in which they exercise expertise and confidence. How does the approach differ however between the musician and non-musician? (Radvansky, Fleming, & Simmons, 1995). In this study an examination was made of the similarities and differences in the memory skills for melody. The experiment demonstrated that it was the non-musicians who relied most heavily on timbre. When timbre was changed during the experiment the musicians were able to rely on their melodic memory. The conclusion can be drawn that the musicians were able to call into play a more sophisticated aural abilities. The non-musicians on the other hand were only able to note that there was a difference in timbre.

As an educator I am most interested in how children utilize musical memory. Much can be learned by how the young child processes information. In (Serafine, 1981) children were studied so as to investigate their ability to process what the potential combination of musical timbres would be if sounded at the same time. The children were asked to remember previously heard timbres and were challenged to not only recall them, but to be able to predict what they would sound like if played together. The tasks which were administered measured

their ability to remember previously heard single and combined timbres and assess their anticipatory abilities. The findings were that the children that were most successful had the ability to utilize the components of the tasks as separate entities, and could effect through memory and imagery the desired understanding of combined timbres.

3.8 The Mozart Effect

Serafine (1981) has demonstrated that musical memory involves very complex neurological processes at many levels of cognition and abstraction. However, as stated elsewhere, we utilize our memory systems only after the senses have been stimulated. There needs then to be some initial stimulus, which begins the process. In the case of music, therefore, we must take a look at the auditory system and, specifically, the ear as sense organ. Researchers tell us that auditory localization especially in the working memory domain, utilize a network of brain areas including the superior, middle and inferior frontal gyri (Martinkauppi et al., 2000). Many physicians and psychologists believe that the ear is the most significant sense organ. The cochlea is completely developed before the fifth month after fertilization and the total hearing apparatus is totally formed operational and complete even before birth. The most amazing contributions to the field of hearing have been in the experimentation of Alfred A. Tomatis, a French physician who developed a system of bringing children back to the time in the womb through a complicated system of filtered sounds and voices. (Tomatis, 1991). The claim of Tomatis is that some childhood disorders, i.e. autism, dyslexia, etc. have their beginnings in the womb, and that some of these disorders can be treated successfully through his sophisticated method of auditory retraining. Tomatis finds that especially when working with children the mother's voice, the music of Mozart or Gregorian chant appear to work decisively (Madaule, 1994). The evidence apparently points to a developmental process, which utilizes contextual elements including the process skills, memory, and the ability to call upon knowledge already learned (Boothroyd, 1997).

The success using Mozart's music has led to a great focus on the healing and creative process and has been dubbed 'The Mozart Effect'. Amazing uses for music have been found worldwide and have created a interest in the powers of music in the medical, psychological, and in the educational fields as well (Campbell, 1997). These findings are not just found in the fields of Ireland or in the plains of Mongolia, but are also being demonstrated scientifically.

Recently in Georgia, Governor Miller impressed with the research decided to offer and to allocate a large sum of money to purchase for every newborn a tape of classical music intended to increase and foster brain development. In the medical field, Mozart's music has been apparently used to lower blood pressure, and assist in most healing processes (Campbell, 1997). Mozart's music even appears to assist patients who have suffered epileptic seizures (Hughes et al. 1998). The findings are that the music of Mozart effected great physiological changes in the brain waves of these patients in a most positive way. Indeed, studies do indicate that musicians can promote changes in brain activity, which manifests in behavioural changes.

The Mozart effect has come under close scrutiny in recent years. It began with the Rauscher and Shaw study, where the conclusion was drawn that the music of Mozart raised the spatial reasoning scores on IQ test. This conclusion immediately drew much fire as being inconclusive. A flurry of similar studies ensued trying to prove or disprove the theory. A few studies followed and demonstrated that listening to Mozart did enhance spatial reasoning in short-term memory (Rauscher, Shaw, and Ky 1995), (Rideout and Laubach, 1996). Tests were also performed using white noise, silence, Mozart, and the music of Philip Glass. The results were similar to the above findings. Spatial-temporal learning was higher when Mozart's music was played (Rauscher, Robinson, Jens 1998). Others tried to duplicate the original study but failed to find a significant improvement of short-term spatial tasks, though some positive influence was noted (Rideout and Taylor, 1997). The researchers Rauscher and Shaw commented that since similar testing was done with different outcomes, the probability exists that the different methodologies may be the underlying cause for the varied findings (Rauscher & Shaw, 1998). Rideout admits this possibility and finds that a Mozart Piano Sonata did demonstrate improvement on a spatial-temporal task (Rideout, Dougherty, and Wernert, 1998). The debate however continues with a recent finding that what Rauscher and Shaw discovered is inaccurate and that there is no apparent Mozart Effect (Steele, et al 1999), (McCutcheon, 2000).

In terms of epilepsy and the Mozart Effect, as recent study found that there is a long-term effect within the cerebral cortex with the music of Mozart especially, but also of J.C. Bach, and J.S. Bach (Hughes and Fino, 2000). Music however is used successfully in the healing processes in many instances. There is a young woman who was a professional oboist.

She was involved in an accident where she was swept down a river and suffered cardiac arrest and hypoxic brain injury. In these post-trauma years family, educators and friends are using music successfully to assist her in her healing process (Seibert et al., 2000). One recent study demonstrated that music was indeed an effective tool to combat and reduce blood pressure, respiratory rate, and psychological distress in invasive cardiac patients (Cadigan, et al. 2001) and even during the pain and stress during labor and birth (Browning, 2000). With all the evidence although challenged on many levels, seem to indicate that music does possess a power that transcends, and does assist in the healing processes.

3.9 Dichotic Listening

There have been many interesting studies regarding the process of hearing and which ear may be more effective in different tasks (Kallman et al., 1987). It has been proposed that there is a direct correlation between how pitch information is assimilated as compared to which ear was the receiver (Deutsch, 1978). In this experiment it was found that the interference lessened when it was presented to the listener contra laterally. In other words when an interfering stimulus was presented to the same ear, the negative effect was increased. Other similar experiments like those of Kimura have come to similar conclusions (Kimura, 1964; Kimura, 1967). In terms of auditory spatial processing it was revealed in a recent study that the right hemisphere indicated increased blood flow during a sound localization task (Weeks et al., 1999). Hearing and interpreting the element of pitch memory is in a sense isolated. As musicians and/or just listeners, we don't concentrate solely on pitch, but what pitches do for us as melodies. When a listener hears a familiar melody the brain utilizes the structures located in the frontal cortices meditating a semantic musical memory (Halpern and Zatorre, 1999). It would appear that information of a melodic nature would increase our ability to remember and recall patterns. The sense of randomness is eliminated. In studies of melodies and titles and the concept of 'feeling of knowing' melodies proved to be recognized more accurately than titles (Peynircioglu et al. 1998). An aspect of melody that assists us in memory is that of melodic contour (Trehub, Bull & Thorpe, 1984; Watkins, 1985). One study suggested that intervals were analyzed primarily in the left hemisphere, and melodic recognition and its contour were right hemisphere related (Peretz and Babai, 1992), (Lechevalier, 1997). The element of melodic contour is so important that if we were to take a

famous melody and change the octave of notes randomly it would almost be impossible to recognize. A study by (Dowling, 1977) placed the successive notes of "Yankee Doodle" in different octaves. The findings were the same; even familiar songs become unrecognizable when the melodic contour has been manipulated. Dowling also found that if the contour remained somewhat intact, the recognizability factor increased. A similar finding occurred in infants and their ability to perceive melody through melodic contour (Trehub, Bull, & Thorpe, 1984). It should be noted that our perception and memory of melody incorporate many other musical characteristics that can aid us in the melodies recognition. One can be influenced by the contour, timbre, rhythm, etc. of a given melody. This has been demonstrated in infants (Trehub, 1987) as well as adults (Dowling, 1982). Infants in fact apparently have a better command over musical memory than recently thought. A study testing seven-month-old infants and their memory of two Mozart Sonatas suggested that the infants retained the familiar passages in long-term memory even after a two-week interval had elapsed (Saffran et al. 2000).

3.10 Handedness

The concepts of handedness and brain research have been very fruitful as patterns develop and new insights made (Steinmetz et al., 1991). With the advent of the fairly recent documentation of sensory dominance, which has affected the fields of neuropsychology as well as education, proponents claim that great insights can be made when a person comes into the knowledge of their dominance profile. There is evidence to support that we do have dominance in how we perceive and interact with the world. We all know that we have a dominant hand or foot, as these are readily recognizable. The claim is that we also have a dominant ear, eye and brain. It has been well documented that ear dominance (Hugdahl, 1997) and the dominance of brain hemisphericity (Kimura, 1964), (Springer & Deutsch, 1998) have proved to be most interesting and for which the impact on psychology, music, education, and so on has been widespread. Each person has a dominance profile that is unique to his or her own situation. One can favor either side of any modality. As most people have mixed dominance recent research has indicated that there are 32 dominance profiles (Hannaford, 1997), which give insights to learning styles and strategies. A most interesting point raised by researchers is that there is the strong possibility that the dominant ear should be contralateral

to whichever hemisphere is language centered (Madaule, 1994). In most people this should mean that they have a dominant right ear because of the left-hemisphere controlling the language centers. The neural route from the right ear to left-brain is shorter due to the fact that our brain hemisphere is opposite that of the side of the body receiving the sensory information.

In this section we will discuss hand dominance and examine what the literature has suggested regarding this. In memory theories, cerebral lateralization (the concept that the brain consists of two hemispheres, and that each is responsible for different activities) is examined quite closely because of the insights one can gain by understanding how information is processed by the two hemispheres and what ramifications this presents to education, medicine, and psychology. It is known that 99% of all right handed people utilize the left hemisphere for language and that there is apparently a greater use of the right hemisphere when language processing occurs in the left handers (Tzourio et al., 1998). What does handedness have to do with musicianship (Hering et al. 1995)? Is a right handed player more attune to technique because of the dominant left hemisphere, or is a left handed player better at playing with emotion because of the affective qualities of the right hemisphere ? In a study by Christman (1993), handedness was examined in musicians, and showed how handedness functions in relationship to the instrument played. When playing an instrument that requires bimanual ability, one wonders if the motor skills of both hands are related to the degree of handedness? As the literature points out Christman finds that fine motor control appears to be controlled contra laterally in right handers whereas in left handers it appears to be more bilaterally based. This is true for most instrumentalists including woodwind and string players. In the keyboardist, bimanual activity occurs independently. Other findings indicate that musicians, probably due to early and intensive training measured higher in terms of overall ability in left or mixed handedness. Jäncke, Schlaug & Steinmetz, (1997) claim that it is the early training and number of hours of exposure to practicing that created a conducive environment for these abilities to become manifest. Does the concept of handedness affect how we perceive and internalize emotional valence? One study suggests that handedness may affect the processing of emotional valence in dichotic listening (McFarland & Kennison, 1989), where right-handers experienced positive effect in the right ear and left-handers experienced positive effect in the left ear.

3.11 Aphasia

Before discussing the relationship between aphasia and amusia, it is helpful to take a brief look at aphasia since it is probably the most common form of dysfunction stemming from TBI (Luria, Tsvetkova & Futer, 1965). Aphasia is a difficulty that arises from damage usually to the left or dominant hemisphere. A person with aphasia is found to be lacking in their ability to understand language or to speak, demonstrating that there are two basic types of aphasia; receptive and expressive. The receptive component is of a sensory nature. That is, like all cerebral function, it begins with the senses. What we feel, taste, see, and hear is registered in a complex series of neurological processes. The expressive form of aphasia is also related to the motor functions. For example, one's speech may be affected, or as in many stroke victims, there is a disturbance in the ability to move about. Expressive aphasia is essentially a paucity involving an impairment in speech. Because of the particular area in the brain which is affected, expressive aphasia is also called Broca's aphasia.

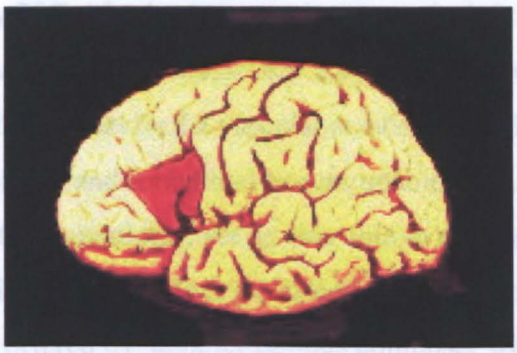

Figure 2 The area in red is named after Paul Broca who noted that damage to this area resulted in a form of aphasia.

If damaged, frontal regions of the left hemisphere which control speech will result in this form of aphasia. Wernicke's aphasia, another name for receptive aphasia, is a disorder of the patient's ability to understand speech. These patients can appear to be more able to communicate but depending on the variables involved, one may find their use of words totally meaningless or inappropriate and may include word deafness when damage occurs in the left hemisphere (Takahashi et al. 1992). With bilateral damage in the temporal lobe however deafness may occur. One patient with a cortical hearing disorder exhibited an ability to hear simple sounds, but not complex ones as you would find in music or speech (Pamphlett and Morris, 1983). After a ten year bout with meningitis a woman developed cortical deafness due

to bilateral temporal lobe lesions which also extended into the parietal and frontal lobes adjacent to the initial lesion. Testing demonstrated that she had a total absence of spoken language among other difficulties including receptive amusia for rhythm, pitch, and melody. The effect however of the pleasure of music continued (Lechevalier, et al. 1984). In terms of the parietal lobe, it has been shown in a recent case of damage to this area of the brain, specifically the left upper parietal area, can cause both agraphia and musical agraphia (Midorikawa and Kawamura, 2000; Paolino et al. 1983). It is interesting to note that singing ability appears to be preserved in many cases where the right hemisphere is dominant over the left (Yamadori et al. 1977). Singing in fact has been demonstrated to be preserved or can even improve language facility in aphasics in patients with left hemisphere damage (Cadalbert et al. 1994).

More often than not, patients with aphasia demonstrate some disturbance in musical function, while others have had severe aphasia and yet their musical ability appeared intact. The research about Professor Shebalin, (Luria, Tsvetkova, & Futer 1965) demonstrated that while approximately 70% of aphasics experience musical dysfunction, some clearly do not. Professor Shebalin was a Russian composer born in 1902. He suffered for many years due to hypertension. In 1953 he survived a vascular accident, which occurred, in the left hemisphere. Shebalin became aphasic and found that he was unable to understand the spoken word and that he himself could not communicate, yet he was able to continue as a composer and had numerous well received compositions published and performed after the trauma.

An example offered by another famous composer who did experience some loss of musical skills is that of Maurice Ravel who became aphasic at the age of 58 after experiencing a form of progressive left-hemispheric damage (Alajouanine, 1948) and who eventually died as a result of a craniotomy in 1937 (Baeck, 1996). He had been seen for a psychiatric disorder up until the age of 52 when the brain disease was diagnosed (Henson, 1988). The ultimate result of the damage was the diagnosis of Wernicke's aphasia. Although this diagnosis is disagreed upon by many, it is apparently some form of a progressive degenerative disorder (Alonso and Pascuzzi, 1999.)

Figure 3 The area noted in darker color is know as Wernicke's area. His ideas though based on Broca's findings found that damage to this area resulted in a non-expressive form of aphasia.

In 1874 Carl Wernicke published a paper explaining that there was a second major center for language in addition to the earlier findings of Broca. It was Paul Broca who first found a particular section of the cerebrum that appeared to be responsible for the production of language (Filley, 1995). Lesions or other dysfunction in this area prevents the components of sentence structure to be compiled. Wernicke showed that some patients possessed a language deficit in comprehension not in expression. These patients could speak well but without meaning, often incoherently. The simplest commands would not be understood, familiar objects not identifiable, yet they are seemingly unaware that any dysfunction exists. This form of aphasia usually stems from a lesion in the posterior portion of the left temporal hemisphere, but in the case of Ravel it appears that because of his extraordinary talent, one study speculates that perhaps he was able to draw upon a right-sided cognitive system (Cytowic, 1976). Ravel who possessed absolute pitch, lost this unique ability along with much of his language skills. The cause of Ravel's aphasia is not known, except that in a post mortem examination they found some enlargement of a portion of the brain. However, the effects of Ravel's trauma were obvious. He became alexic, as his letters to friends and relative indicated an increasing number of spelling errors. Both oral and written language were impaired, while the understanding of language was slightly better (Kerner, 1975). His musical abilities were affected more so in the written form than in his ability to think musically. A recent study

proposes that the last two compositions of Ravel, Bolero and The Concerto for the Left Hand, may indicate some manifestation of the disease on the creative process of Ravel (Amaducci et al. 2002). Ravel's right brain was able to conceive melodies and compositional concepts but his left brain could not articulate these ideas (Sergent, 1993). Melodic recognition appeared to be well preserved, yet recognition of notes and musical dictation were very much impaired as was his note reading/writing, and his ability to play the piano. There have been some attempts to understand what was the cause of Ravel's illness. A recent look into the literature (Baeck, 1996) explains Ravel's illness as a corticobasal degeneration. Another recent study showed that the amusia suffered by Ravel is a common occurrence with stroke patients. The basic cause of the illness was found to be more generic in nature and not specific to the cognitive processes involved in music (Munte et al., 1998) though they certainly were affected.

Another musician who suffered trauma to the left-middle hemisphere developed aphasia yet he was still able to perform with almost all of his musical abilities intact (Basso and Capitani, 1985). It is interesting to note that other famous musicians developed various neurological disorders. George Gershwin died suffering from a glioblastoma in his right temporal lobe (Silverstein, 1999). In the jazz world Charles Mingus, believed by many to be one of the great bassists developed the neuromuscular disease known as amyotrophic lateral sclerosis (ALS) which took his life before the age of 60 (St Louis, 1999), Sergei Prokofiev died of a cerebral brain hemorrhage (Hingtgen, 1999) and Felix Mendelssohn who it is believed suffered a subarachnoid or intracerebral hemorrhage (Cherington et al. 1999).

3.12 The Planum Temporale and Language

An area of the brain in the left hemisphere, which is known for it's processing of language and linguistics, is known as the planum temporale (Binder et al., 1996). Studies have noted that the planum temporale is under most circumstances, larger in the left hemisphere than in the right (Shapleske et al., 1999). Due to the fact that the planum temporale has been proved to be an essential element in the understanding of language it has been surmised that this may be the reason for the asymmetry. It is this specific area which is an integral part of Wernicke's receptive language area, and plays a role in normal function in terms of musical talent and ability (Braun, 1998). In recent years renewed interest of the planum temporale has provided a different source of interest for research. The planum

temporale is a triangular area situated near the temporal gyrus. Recent research on primates that examined this area of the brain and its function in language, has caused scientists to realize and examine the fact that this asymmetrical language center also exists in the chimpanzee (Nelson, 1998). This created quite a stir in the scientific community, as it seemed to imply that the chimpanzee has the ability develop their own language. Prior to this there was a theory which had been believed for many years that only humans possess the enlargement of the planum temporale in the left hemisphere. Not only do the chimpanzees possess this language area, but it is proportionately the same size as in humans. A later study confirmed the same findings with the great ape who also possessed an asymmetry in the left planum temporale (Hopkins et al., 1998).

As a musician it was interesting to find out that in looking at the function of brain structure and left-right differences, that there is a direct correlation between these asymmetries and particular human talents. Apparently there are specific anatomical differences in people with particular talents. For instance, musicians who possess absolute pitch were found to have an even stronger leftward planum temporale asymmetry than other musicians without absolute pitch (Schlaug et al., 1995 February). This lead researchers to come to the conclusion that since the planum temporale plays a major role in language which begins developing in young children, this may be why early training is a definite element in the acquiring of absolute pitch. A recent study demonstrates the importance of music in the development of the reading process as well as phonological development (Anvari et al., 2002). In an investigation on the neural basis of absolute pitch, imaging techniques were used to measure cerebral blood flow when two groups of subjects (musicians with absolute pitch and those without) were presented with auditory stimuli. The findings were similar to the above; musicians with absolute pitch had a larger left planum temporale than the musicians without absolute pitch (Zatorre et al., 1998 March).

Cerebral blood flow indicates activity during operations which utilized specific areas of the brain. A test involving singing found through cerebral blood flow that similar areas to speech and motor control were activated (Perry et al. 1999). There was found in a study that while the basic internal language exists between those with absolute pitch and those with relative pitch, the basic brain activity is quite different (Barnea et al., 1994). Absolute pitch

was retained by a 17-year old pianist who suffered with intractable seizures and who underwent an anterior left temporal lobectomy. Although in a short-term memory task of a verbal nature he was impaired, in a similar look at his identification of notes remained intact and as accurate as before the procedure (Zatorre, 1989).

A study also examined whether there were any anatomical degrees of planum asymmetry and dichotic listening. One study was not able to prove that there was any advantage in the correlation between left and right-ear listening (Jäncke and Steinmetz, 1993) whereas a more recent study looked at planum temporale asymmetry and ear advantage in children having developmental dyslexia and ADHD. In this dichotic listening study it supported claims that individuals with deficits like dyslexia tend to have a reversal of asymmetry. In other words, instead of having a leftward asymmetry, these children with dyslexia had a larger rightward planum temporale asymmetry (Foster, 2002). Other asymmetries exist in musicians. It was also found that the anterior half of the corpus callosum in musicians is larger than non-musicians, especially those musicians who began their training early in life (Schlaug, 1995 August).

It was found that the asymmetry in the planum temporale correlates with hand dominance as left-handed subjects were found to have a lower degree of leftward asymmetry than right-handers (Steinmetz et al., 1991). In a later study these earlier findings were confirmed as the frequency of asymmetry was conversely found to the contralateral side. In other words rightward asymmetry was found to be higher in right hemispheric speech , and leftward asymmetry is lower in those with left hemispheric speech centers (Beaton, 1997). Another study found that left-handed individuals had a strong leftward asymmetry in the planum temporale with left-hemispheric speech representation with apparently no implication regarding handedness (Moffatt, Hampson, and Lee, 1998). Recent findings indicate that modern imaging techniques afford researchers the chance to accurately understand the asymmetry of the planum temporale in the normal intact human brain (Steinmetz, 1996). Through these imaging studies it was noted that the planum temporale asymmetries are associated not only with language dominance but also with language laterality (Foundas et al., 1994) and experts have begun to look into the area of the asymmetry of the planum temporale and its relationship to men who have developmental dyslexia (Rumsey et al. 1997). These

recent findings concerning the planum temporale have also impacted the field of dyslexia and schizophrenia, in that persons with dyslexia and schizophrenia do not appear to have the normal leftward planum temporale asymmetry (Morgan and Hynd, 1998), (Semrud-Clikeman, 1997). This is true of other developmental language impairments as well, where there is a reversed asymmetry or symmetry in the planum (Gauger et al., 1997), (Preis et al., 1998). There has been some attempt at explaining this physiological symmetry but no conclusive findings as yet have been offered.

3.13 Auditory Processing

In the realm of auditory processing it has been observed that when there is unilateral damage to the brain, the ability to hear and understand music may remain unaffected yet the patient may have difficulty in the perception of voice (Roeser & Daly, 1974) or musical interpretation of the auditory (Peretz, 1990). How the brain interprets auditory stimuli in terms of dichotic listening tasks has led to many interesting studies. One study examined the perception of digits, melodies, and chords in college age musicians. These students were presented with auditory stimuli presented in both ears at the same time. The results were that the "left ear showed a significant superiority over the right in recognizing chords..." (Gordon, 1970). In non-musicians a similar finding occurred in that the recognition of chords also showed left-ear advantage (Peretz & Morais, 1979). It is apparent that musicians use the analytic left-hemisphere to process musical data while the non-musicians use their right-hemisphere (Johnson, 1977). The same aforementioned study also found that as a person becomes increasingly familiar with music, left-hemispheric use increases. This most likely is due to the fact that an increase in musical knowledge can offer an analytic strategy which ignorance lacks.

3.14 Imaging

As a means of ascertaining hemispheric lateralization in speech and singing, testing was done by injecting sodium amylobarbitone intracarotidly. This method was developed by J. Wada and has been used since the 1960's (Trenerry and Loring, 1995). Although newer and more accurate imaging techniques have been developed over the last decade or so, I mention the Wada Test because a great amount of insight and data was achieved by this test. One of the original uses for the Wada test besides that of ascertaining language function was to assess the

risk involved in amnesia patients and the probability of postoperative complications (Snyder and Harris, 1997). The Wada test depresses hemispheric function unilaterally for up to five minutes during which time the unaffected hemisphere can act independently of the other. All mental processes and movement will operate contralaterally to the injected side. There had been some important discussions because of some findings concluded that this procedure alone lacked possible insights into other viable medical options (Loring et al. 1990, April).

An interesting case provided by (Loring et al. 1990, March) demonstrated that preoperative intracarotid amobarbital testing led surgeons to discover that one right-handed patient possessed right-hemispheric language dominance, though there was some bilateral language dominance. This was a most valuable insight in the treatment of the young man, in that we have come to learn that most right-handed individuals possess left-hemispheric language dominance.

The Wada test also provided information regarding music ability and brain function. In terms of testing for music ability, in one study the findings were that after the right carotid injection speech functions remained intact, but the ability to sing was markedly affected (Gordon and Bogen, 1974), (Gordon and Bogen, 1970). This is also made manifest in music therapy sessions where patients with TBI were severely aphasic, yet they were still able to sing. In the above studies, songs were sung in a monotone fashion and though the patient apparently knew when melodic pitch changes were to occur, were unable to comply adequately. The findings also indicated that rhythm was not as affected as melody as the rhythmic structure was recognizable and accurate. This ability to keep a rhythmic memory sense and lose the melodic elements was also found in a patient who suffered bilateral temporal lobe damage. She was found to have lost her melodic and pitch memory and yet retained her rhythmic and temporal capacities (Peretz and Kolinsky, 1993), (Fries and Swihart, 1990). This resulted in a new look at the concept that even though rhythm and melody are both musical elements and formally were treated as if they were integrated in some way, they are in reality stored in at least two separate memory areas. Indeed it is even proposed that in the temporal confines, meter and rhythm were found to have dissociation (Liegeois-Chauvel, 1998). Therefore, even when examining rhythm, there appears to a subdivision here as well.

When looking at the concept of rhythm and its effect on the motor system, it has been observed that it is the time structure that is inherent in the music process which is the primary element relating rhythm and motor function (Thaut et al., 1999). A study designed to test memory for unfamiliar tonal patterns in the right temporal lobe during the intracarotid sodium amylobarbitone procedure was conducted on patients with either right temporal lobe epilepsy or left temporal lobe epilepsy (Plenger et al. 1996). According to findings of this study, there was not a distinct difference between the left temporal lobe epilepsy and the right temporal lobe epilepsy when the injection occurred in the right side. However, there was noted a difference during left injection, the left temporal lobe epileptic group performing better than the right temporal lobe epileptic group. This would indicate and support a role of the right temporal lobe in music memory. An excellent article relating to a review on the findings of cerebral function and its effects on music skills using sodium amylobarbitone was compiled by Robert J. Zatorre and gives an overview of the research up to that point (Zatorre, 1984).

In the last 30 years great strides have taken place in our understanding of the brain. We know that both halves of the brain resemble one another anatomically and that the corpus callosum, through its network of nerve fibres connects these two hemispheres. However, as close as these two hemispheres look physically, they are in fact responsible in the processing of information in very diverse ways. Studies of music dysfunction lead one to believe that a bilateral understanding of the brain is too limited for understanding concepts of music making and music memory. It appears that more can be learned about how the brain interprets musical data by studying damaged brains, rather than studying normal brains. Musical tests can be administered to the normal population and the results will only indicate one's current abilities. With the brain-damaged, not only can you assess their current abilities but draw corollaries using the normal population. Once the trauma area of the brain has been diagnosed, assumptions can be drawn on the localization of musical functions. This section concludes that examination of the clinical evidence. What will be presented following, is an analysis of the twelve interviews conducted, to look at what the interviewees believe is occurring in their lives. The literature presented in the last section was based on empirical research and clinical evidence while the next sections will be an examination of the perceptions and world-views of the interviewees. This is an important perspective in that the interviewees have definite and

realistic ideas of what is occurring, and yet their opinions and insights are ignored by most forms of research. My approach is to allow the interviewees to speak for themselves and to apprehend and express their ideas and their overall world-view.

4 Analysis of the Narratives

4.1 Introduction to the Narratives

In terms of anatomy, the brain is the last great frontier. Researchers have been probing the brain's many functions as scientists examine the neurophysiology of this complex organ but despite the many breakthroughs empirical research has made and continues to make, scholars keep reminding us that the knowledge of the human brain is still perhaps in its infancy. The question of memory and localization of function, neurobehavioural anatomy, and those questions of philosophy still tell us little about this three-pound organ which dominates and controls our life. In the complexity and apparent slowness of the research process the brain will continue to hold a distinct and high place in the topics of research for a long time to come. Admittedly, there is much to learn regarding the "normal brain," and while study upon study purport to find out specifics regarding brain function, what of the damaged brain? Each and every day hundreds of individuals regardless of age or station in life experience some form of injury to the brain. Brain injury creates another myriad of examination possibilities, some of which are so out of our ken that the adage, "truth is stranger than fiction," rings true. Yet, in many ways the examining of patients with brain trauma have provided at times many valuable insights for understanding the normal brain. Many researchers feel that it is more probable that greater insights can be made in examining a damaged brain then in examining a normal brain.

This thesis is examining the musical side of brain damage, although other aspects will be mentioned due to the fact that traumatic brain injury does not occur in a vacuum. There are many other categories, which need to be looked at so as to give a balanced view of the situation. Amusia then, along with other dysfunctions experienced by the subjects interviewed has been investigated. The Literature Review presents the research of Neuromusicology past and present and in the appendix the reader will find the transcripts of the twelve interviews conducted with musicians. This section will deal with an analysis of the interviews and will provide a look at forms of musical memory and the interviewee's perception of those skills.

Music is such a high level skill that it utilizes many varied areas of the brain. There are however, elements of daily existence, that of language, memory, motor function, and perception all of which will also be discussed. The subjects who were interviewed are unique

in the sense that questions of self-perception were asked so as to elicit information of their own self-awareness and introspection. This focus is often ignored by researchers in most clinical settings. Many researchers prefer the genre of clinical observation and while this is an invaluable aspect of research, this thesis will also look at the subject's own understanding of their disabilities. It proposes to examine how they have utilized their musical memory in light of their TBI, and will compare this data with pre-trauma strategies. In the following sections of the thesis we will be examining in what way the interviewees interpret their own understanding of pitch, memory, elements of music and the physiological ramifications of Traumatic Brain Injury. A closing section will discuss the work of Dr Alfred Tomatis and his subsequent work in the rehabilitation of brain damaged individuals.

The great debate between the two concepts of nature or nurture is still ensuing. These two ideas have been promulgated for quite sometime, and have had scientists on both sides arguing for their own camp. Do we learn most things through our environment or are they inherited? Is a young child a clean slate ready to be filled with information, or do they come with inclinations and predispositions? The brain appears to be the battleground for the study of these two diversified areas. Scientists had tried to come to some objective conclusion about which is dominant, nurture or nature, by studying twins separated at birth and who had no contact as they grew. Although similar genetically they were dissimilar though their upbringing. Some of the conclusions drawn from the study were that intellectual functions are mostly inherited, as were phobias and fears, yet the more sociological and emotional elements appeared to be primarily of how the child was reared. Trying to understand this in terms of musical talent and ability there would still be a conflict, in that music has most definitely an intellectual component, but it also has an affective dimension. Music encompasses most of the cortex, receptively and expressively. We also know from experience that artistic talent is handed down from generation to generation. Where does that leave us? According to the interviewees in this present study, it appears that almost all who are musical currently had somewhat of a musical beginning at a young age either in study or of one or both parents pursuing music to some degree. That still does not really answer the question, in that biologically they may have been predisposed to music, but all were obviously nurtured as

well. Each interviewee was supported generously by their parents, one subject beginning her piano lessons as early as age two.

A fair compromise would be that a child possesses some inherent talent for music and then begins the quest for additional musical knowledge through nurture and the early communication of those around them. It has been medically proven that a child in the womb has the apparatus for hearing at 4 1/2 months gestation. The mother's heartbeat as well as the other sounds a child hears all have a specified and consistent rate. Sounds of digestion as well as speech patterns, respiratory sounds all begin to create for the child a temporal plane upon which they will build concepts for understanding the sequences of sound, movement, and speech.

When reflecting on an infant and their perception of the world, we know that their learning process has begun in the womb through the mother's body as well as aurally. As very young infants learning occurs most especially through hearing and so frequent testing can be administered to diagnose possible hearing loss and auditory disorders. We can see infants reacting to family members, harsh noises, and we can observe their first attempts at grasping an object. These young children are sensory beings and though sensory and communicative abilities are limited, they are beginning to formulate their understanding of the parameters that limit their existence. The nurture aspect of their life has begun through communication with the outside world, but for all intents and purposes is one-sided, for information may be received, but not expressed fully as yet, though no doubt some attempt may be made. Is there anything regarding infants that research can tell us regarding music and their ability to perceive and understand auditory stimuli? Young infants have been shown to possess a perception regarding musical sounds in terms of structure and affect and that the earliest communicative efforts of the infant, revolve around vocal interactions and mimicry. These behaviours acknowledge the interactions of sequential communications in voice, face and movement of body in that they occur in short cycles of attention and inattention.

In tests and surveys completed on musicians and non-musicians it was discovered that one person in every 10,000 have absolute pitch. 95% of those with perfect pitch began their musical training before the age of seven. Most scholars admit that as absolute pitch and genetics are concerned there is no ready answer quite yet, other than the anatomical structure

of the planum temporale which shows a leftward asymmetry enlargement. There may be some genetic predispositions, but there are also many success stories when training at a young age occurs. These people are in a definite minority having this unique ability in that they are able to identify pitch names without reference. This is done without cognition, instantaneously and with accuracy. Most musicians have relative pitch, that is having the ability to think through intervallic relationships by way of a reference pitch, utilizing some cognitive strategy. Most infants were shown to possess this unique ability at birth. The skill is lost in most when the transference of brain hemisphericity occurs during the acquisition of language skills. Many studies have affirmed that infants have the inherent ability to make sense out of sounds by their able ness to recognize patterns and sequences. Melodies are recognized by infants even when transposition occurs, (Trehub et al, 1984) yet in more recent studies (Hall, 1999), (Saffran and Griepentrog, 2001), (Bergeson and Trehub, 2002) where researchers examined both adults and infants for disposition to absolute pitch. In the Hall study for instance, a melody was played upon which transpositions of the same melody were extrapolated. The original melody was played again intermingled with the transpositions to see if there was any recognition of the original sequence. The findings were that it was the infants and not the adults that were able to recognize the version with the original beginning pitch. The adults were able to recognize similar melodic structures and contour when transposition occurred, but did not know when the researcher played the original set of pitches. The infants on the other hand, did not appear to recognize the transposed versions but showed that they did in fact recognize the original form of the melody when it reoccurred. The conclusion drawn was that infants are born with a sophisticated and innate sense of absolute pitch. There are apparent reasons for the loss of this special skill. When an infant is born the dominant brain hemisphere is the right. As language is acquired and grammatical and semantic skills are learned, the dominant hemisphere switches to the left (for most). Scholars think that it is this transference of dominance which accounts for the loss of absolute pitch. Are there other cultures which retain absolute pitch? It was found that that in certain Asian cultures, specifically Vietnamese and Mandarin Chinese, where absolute pitch is retained in most children. The reason for this is most likely that these two dialects utilize pitch related words. This means that the child is used to hearing specific words at specific pitches. If a different pitch were used the meaning would

change. This then forms that bond and association between pitches and word meaning. In Asian populations absolute pitch occurred in almost 48% of the population. As stated before an added advantage in both Asian and Caucasian students was the prevalence of early musical training usually before the age of seven.

One possible reason was that many young Asians have had more intense musical training and exposure. There are methods of instruction for instance that are designed for the purpose of the development of the absolute pitch ability by using a "fixed do" technique. This method uses specific solfege syllables with particular pitches thereby fixating in the mind of the young musician a constant reference point.

According to the study of these musicians and their interviews there were three who possess absolute pitch. All three had early music training and subsequently were trained at higher levels. Each of these interviewees experienced brain damage either by car accidents or one by carbon monoxide poisoning. All of the other subjects possess relative pitch save one, who still experiences some auditory difficulties. Those with absolute pitch have expressed how this skill has influenced their ability to memorize and to perform. In her early stages of training, Ana Maria's teacher would emphasize solfege and memorization. The instructor would place a section of a piece of music in front of Ana Maria and ask her to examine it for all possible elements including notes, harmonic structure, articulations, and dynamics. She would then allow Ana Maria a five-minute period in which to memorize this and perform for which, as the student recalled, was most severe in the critique of her performance. This was a definite style of teaching in which Ana Maria notes was most helpful in her continued and successful use of absolute pitch. This instructor along with others also utilized the importance of solfege in her training. She is now able without hesitation to sing in solfege fashion the most difficult melodic lines at very rapid speed, all performed with the correct pitches.

How do the brains of musicians and non-musicians compare. Are they similar anatomically or does the talents one group possess create change in structure? There are important anatomical differences between the brains of musicians when compared to nonmusicians. This again can impact both sides of nature or nurture. Are the anatomical differences biological in nature or did they occur because of training and environment? Through the use of positron emission tomography (PET), it was found that musicians with

absolute pitch use their brains in a different way than nonmusicians. A musician who possesses absolute pitch according to researchers utilize the left frontal lobe which is where psychologists believe is the housing of associative memory. There is then a neural link from the left frontal lobe to a particular sound and name. There is most likely then a neural link between the left frontal lobe and the planum temporale. Some researchers have examined the parts of the brain having to do with sound recognition. These are found in the auditory cortices in the temporal lobes. Upon examination the left auditory cortex was larger then the right auditory cortex. While it had the same amount of grey matter, there was an increase of white matter composed of myelin allowing the nerves to communicate at a faster rate. When the transference of hemisphericity occurs in very young children from the right hemisphere to the left (dominant) hemisphere there is an anatomical section in the left hemisphere in the temporal lobe which is enlarged. The dominant hemisphere (left in most people) is usually found in right-handed people. Also noted is the fact that the processing of pitch may be found on the left because both verbal and musical skills are required. There was also the discovery that the left planum temporale is also the location of Wernicke's area which is the center for language comprehension. It appears that most musicians utilize their left hemisphere more frequently and to a greater degree when processing analytical modes of music. When more temporal and abstract elements are examined, the right hemisphere is more engaged. These facts lent credence to the theory that complex mental functions do occur on either side of the human brain. While anatomical examinations reveal similar structure there are gross differences in function.

Another asymmetry in the human brain which may account for the development of absolute pitch is found in the corpus callosum which for those musicians who began their training before the age of seven is enlarged in the anterior half. It is known that the corpus callosum is the primary communicative bundle of fibers which allow both hemispheres to be neurally connected. Therefore some researchers came to the conclusion that it is because of the increased communication between the right and left frontal lobes that may have been the cause of the enlargement of the corpus callosum and the resultant effect of increased skill on the part of the musician.

The following sections will offer the reader the primary ways in which musicians use their musical memory. We will be examining by way of the musician's words themselves how 'normal' and brain damaged musicians approach this task. Will the approach be similar to memorization between the two groups, or will the difference be obvious and diverse? In clinical studies a very small part of the process is examined and analyzed, and for the most part without any insight from the subjects themselves. Many studies looked at melodic recognition for instance (Dowling, 1977), (Boucher and Bryden, 1997), (Kimura, 1967), but never ask to find out why they remembered the melody, only if they did or not. Perhaps the subject thought the melody beautiful, or sparked a happy memory and not just because they were left-ear dominant. The reason why these insights are not usually asked is that it would entail a qualitative examination which to many minds would not be clinical. It is my feeling that these questions are important and may provide insight into the question of "why".

The next few sections will examine the musician's perspectives regarding the various strategies of memorization. The self analysis of the musicians were more often then not very enlightening and showed very keen insight to their own unique personalities, as well as offering valuable strategies to the process of musical memorization. The parameters that the musicians themselves set up offer much food for thought in the memorization process. These sections will illuminate how similar or dissimilar strategies may be used by 'normal' and brain damaged musicians.

4.2 Pitch/Melody

When comparing the worlds of musicians and non-musicians there are numerous differences in how each group approach the listening process. Those who have been trained in music may offer some different and valid esoteric views, but listening and the music process is for all even the untrained. This is proved by the fact that in every culture and time there is evidence that music has been an integral part of these cultures. Those trained in music may focus on more abstract concepts such as harmonic analyses or melodic contour because of their expertise. Those not trained in music may prefer to allow the music to move them emotionally, to dance to it or merely to let the music distract them from everyday cares and worries without giving any thought of what in the technical sense may be happening. It should be said of course that either group may enjoy any of the aspects mentioned at different times, depending on the reason for listening, the venue or their mood at the time, but either way there is one consistent element that is essential to all people who listen to music, those trained or not. The primary element that is necessary to remember a song, or to hear particular harmonic patterns or even a familiar motif; is that of pitch. While it is true that there are other elements that may call to mind a song, pitch is the most likely.

Pitch, which possesses a particular frequency, is that physical and acoustical phenomenon by which music is made and recognized. It is the smallest unit found in the European/American tradition, analogous to perhaps the phoneme in language (Bernstein, 1977). Pitch is the fundamental of an overtone series which is the one note always recognizable by those who possess absolute pitch or have some mechanical means of pitch recognition. Many have claimed that there is great similarity between vision and the hearing process, using color and sound as the example, but people may argue over what a particular shade of color may be, for everyone has their opinion even among artists, but with pitch it is more scientific, more empirical, more accurate. Each note vibrates at a particular rate of speed or cycles per second. A symphony orchestra in many parts of the world tune to the note A440. This is a process that is used so that when each member of the orchestra plays the same note, they will indeed be accurate. There are some countries especially in Europe which do not use A440 though they are still within the range of the note, their "A" will be slightly sharper or flatter but still remain within the frequency range that encompass an A. For our purposes, let

us use A440. This means that this particular note "A" vibrates at precisely 440 cycles per second no more, no less. Certain instrumentalists rely on this same pitch to tune as in the case of string players here in the United States who almost always tune to A440. Before each concert one can hear the almost cacophonous sounds of an orchestra tuning as they strive to tune the each string and instrument. Therefore after time, even if a musician has only relative pitch their sensitivity to this one pitch becomes more easily recognizable to them. Other instruments whose tuning may differ and which may change according to the ability of the person tuning, the weather, or other outside influences do not always have this same consistency as the orchestral violinist.

The case can be made regarding the guitar whose tuning is at the discretion of the person tuning it, that is of course unless mechanical means are used. The note "A" then may or may not be an accurate 440. A few cents (cent-the smallest subdivision between the two notes in a minor second) either way will not change the integrity of the note "A" but the ideal is to tune accurately and precisely to 440. In school settings, colleges and the like, the ideal is almost never reached in that the young player does not have the expertise to hear the subtle differences at this level. Other considerations are the embouchures of these young players which are not fully developed and the intellectual road to understanding and appreciating the concept of intonation is a long one. The interviewee BM explains that in so far as pianos are tuned there may be some discrepancy between the original tuning and the subsequent effects of time and weather. He says, "and I think it's because as a pianist, all pianos that you play are slightly different pitches, so I think for that reason I've never developed perfect, perfect pitch, as, say, perhaps a violinist might, who always tunes his or her own instrument and really gets a very real feeling of what A440 is." It is the consistency of hearing the same pitch, relating it to the letter for which it is represented that makes one more able to make this association. For BM, his inability to always connect the pitch A440 with his listening ability makes the process more difficult because pianos frequently go out of tune and do not hold the pitches the tuner may have set. BM ultimately feels that since his pitch ability is close to perfect, that had he been exposed to an instrument with consistent tunings, he would have developed absolute pitch.

Melodies are of course made up of various elements; pitches, timbre and rhythms. The pitches are the particular notes which are put together in a creative order to produce something which most composers hope their listeners will remember and appreciate. Many composers agonize over each note in a new melody to make sure that it is a perfect one. Other notes may sound appropriate, but most composers have a very definite sound they are looking for which can only be expressed to their liking by these particular notes. Beethoven for instance, has numerous journals where he composed a particular melody, and then made multiple drafts and configurations of the same melody, changing a note here or there experimenting to make the melody perfect. Sometimes this had taken a fairly long period of time before he would commit to the final version. Media advertisements on radio, television and the like rely on music, or more specifically melody and lyrics to sell their products. Advertisers know that people will associate a particular jingle with their product. The catchiness of the jingle hopefully will cause their product to be bought over other similar products. We of course know that the advertising industry would not spend millions of dollars per year on advertisements if they did not have any indication that their money was well spent.

Almost everyone interviewed in this study claims that they have a specific plan when memorizing music. Many say that they will first learn the melody when encountering a new piece. Melody does not exist temporally without rhythm of course, but at this juncture we are discussing the melody as separate from rhythm. Of all the elements of music; harmony, melodic contour, rhythm, form, etc. the element which stands in the forefront and is associated with every song is melody. This is because it is the most recognizable musical element and for the young player especially, will give a sense that there is some accomplishment in the learning process. As a teacher of young children, there have been numerous times where a student will approach me and state that they have learned a song and with an excited voice will ask me to listen. When they play for me in their halting fashion, most times they are playing the melody only. This is where the association for them comes into play. They believe that they have learned a piece only by being able to play the melody. There have also been times in other musical settings where I am teaching a harmony part to a young child and they invariably ask why "this does not sound like the song." At their young age, they do not hear that music has other integral parts in addition to the most familiar, the melody.

CCT who had an arterial venus malformation at age thirteen still enjoys playing informally. She and I spoke about how she approaches the learning of a new piece. She said that, "I would probably play over the right hand first, so I could get the melody." It seems for most musicians no matter the level of ability the concept of pitch/melody is paramount.

The interviewee CP who is a published composer spoke with me about what he feels is the key to good melodic writing. When writing a piece he will initially draft a melodic pattern, using notes that appear to him will constitute a good melody. Before anything else occurs, CP desires a good strong melody, with features that will strike something inside the listener. First, he feels that writing away from the keyboard is important to the creative flow. Some composers who write in the tonal idiom choose to write with a keyboard to assure themselves that what they are writing is actually what they hear. Many musicians, myself included find that they are not always accurate about putting to paper what melodies I hear in my head, and prefer to use the "crutch" of the keyboard, an inherent need to check my work. CP however feels that he will "always try to ... do the writing away from the keyboard, because the thing is....really melody is purest then." CP prefers going directly from what he may hear in his head to paper, so as not to alter by what he hears aurally with what he envisions mentally. This is a great skill which needs to be developed in most. It requires a trained ear and much practice. Before my interview with CP, I had the pleasure of observing him conducting the school group which he is in charge of. The piece that I heard them rehearsing was written by CP. Subsequent to the formal interview I had asked him whether or not he wrote the piece I heard, which he responded affirmatively. I questioned him further about whether or not he composed this piece without a keyboard. He admitted that he wrote most of it without aid, but that he did correct a few notes which were inaccurate by way of the keyboard. When questioned about why he felt melody was in its purest form when written unassisted CP maintains that, "Because it's real melody...like great folk tunes. Why do they go on forever? Because people, you know...it's perfect melodies." For CP a great folk tune has a good melody, and remains with people in their memory because the purity of writing from the mind is what makes it memorable. He is not against using a piano when the melodies are more complicated, and since he is not a particular proponent of atonal music, CP will readily admit that because of the atonality of the piece he would not rely on his ear solely, but

use a keyboard as well. This does make perfect sense as the accuracy of the melody is paramount to the inadequacy one may feel about initially writing wrong notes, or at least sensing the need to check your work.

Pat Martino, another interviewee agrees with CP when he says that "melodies are essentially magnetic. They will remain in you if they have any value as melodies to begin with." There is an integrity to using pitches which composers use to create melody that will catch the heart and soul of the listener. As a jazz composer Pat uses others means as well to creating melodies. We spoke together about his use of almost random words as a compositional tool, and then using each letter of the word to correspond to a particular pitch. Pat tries to come up with new and different ways to tell a musical story through pitch. Here he talks about taking the words "beautiful and ugly" and by placing various scales under each letter of the alphabet many different forms of melody can be construed. Pat says, "you can do it with color with all of the English words ... in terms of the alphabetic ... what it contains ... spelling. You could take any of those colors ... blue, red, green, the simple ones and the more complex colors ... I don't have one on my mind at the moment ... But you could take the 26-letter alphabet and place different scales of music against the letters themselves. If I were to take ... An example, a good example, was ... If I were to take the word "beautiful" and place that word under the alphabet ... And under the alphabet, first and foremost, to place a C major scale, just for simplicity ... any of the exotic scales can be placed under the alphabet as well, in various orders. You then have the letters of the alphabet ... the first seven letters of the alphabet ... ABCDEFG ... would then automatically return the tones CDEFGAB. You see ... and of course from G, HIJK, and so on an so forth. The next seven would be the C major scale. Then you would have five left for the full 26, from C to G. So Z would be G ... it's on G. You then take the word "beautiful" and the word "ugly," and you now can connotate what the outcome is going to be. The word "beautiful" is going to come up in tones as DGCBADABG. [He hums it] ... is the word beautiful. The word "ugly" comes up as BDED. It would sound [he hums it]. And what is missing is resolution. So now both words are accurately similar in terms of what they're producing as a positive result. And collectively now have a melody as an

introduction to a longer event ... a composition in itself." Pat explained to me that he ultimately enjoys composing from "the heart," but that using other approaches and means to composition has led to some creative melodies. This also extends to his performance where Pat uses the concept of the 12-point star explaining to me that there appears to be a great importance to the number 12, as a symbolic term or one of specific reference. Pat explains, "The term itself is a very general, symbolic term that can be applicable to a number of uses, you know, so it's not specifically determined with music itself and that alone. I remember when I was a child, my mother used to say when it was time to go to school ... I would be lost in lunch, and she would say to me ... "Look at the clock and see what time ... Don't you see what time it is? You're going to be late." And because of that, the clock was the enemy. It was the intruder. It was an abruption in terms of my enjoyment of that particular moment in my life. Um ... throughout my days I began to see an importance of lots of symbols around me that seemed to be separate from what I was committed to as an artist, which was music.

And I began to see that the repetitive nature of symbolism throughout mankind ... in all of our cultures. And the clock is one of them. Having 12 numbers ... the same matches with 12 tones in music. Having north, south, east and west ... the same matches the matrix of a guitar's finger board, or any of the threaded instruments, you know ... or even the unthreaded instruments with strings that move vertically and horizontally simultaneously. Therefore, it was very simple to organize the clock itself in terms of musical tones in a 12-tone array ... so that 12:00, 3:00, 6:00 and 9:00 would be minor thirds of the ... a division of minor thirds in a 12-tone scale. You see ... seen in a circular context. Whereas 12:00, 4:00 and 8:00 would be triadic. They would be major thirds. You see. So here it's provided the neutralization of the difference between the two forms of perception. Now the clock, which used to be an enemy, is the same thing that I was interested in ... that it used to distract me. So it became unified as a whole. That's what the 12-point star is all about. It's the ability to see these standards ... these symbolic standards neutralized in a more unified whole so that 12 months of the year can also be seen in intervallic periods or intervallic divisions. The same thing applies to 12 apostles in the Christian, spiritual context. They too can be seen in symbolic context

... where you have the minor thirds form the plane or the perfect square, the major thirds form the triangle, or the pyramid. So there are many symbols that I find music being a universal language applicable to these symbolic forms. Literally they emerge into it ... like everything else in mankind, it is repetitive in the sense of simplicity." Pat's philosophy is a bit more esoteric than most, but all his ideas are based upon the recognition that music and mathematical elements are different sides of the same coin and that compositional techniques can be pushed and stretched to include many diverse methodologies of the interviewees CC explained that although melody was most important for him, melody and harmonic patterns are really one essence. He says that he hears, "chords and the melody... because they're really to me inseparable. Much like Handel would do, he would have a single melody and then the chords would be supporting that. Unlike Bach, who would have all counterpoint going on. So Handel for me is a lot more relevant in that regard because it's just ... that's how I kind of experience the music ... a melody supported by chords." CC takes this even a bit further as the elements of music are concerned as he does not always separate the elements but hears them as one. This is somewhat akin to the concept of chunking where a person remembers a series of digits by associating some of the pattern to something recognizable. When I asked CC about his experience of memory, melody and harmony he goes on to say that , "Yeah, it's all part of the same experience. It's so hard to separate them (the elements of music) because it seems like it's all the same thing for me. It's just ... It's music. And it's just the way that I hear that ... I don't normally isolate the elements. It's almost like looking at the picture and seeing the whole forest instead of individual trees. Although there's a high amount of detail in what I do at the same time. So it's hard to separate the two."

Others like ED separate the elements one at a time and in a particular order. She says, "OK. I learn the melody first. I put in all of the extra work....I guess I notice that afterwards. I look at what the composer's put down as far as dynamics, and the pianos and the fortes and all that. That's definitely a second...you know, that's after learning the melody. You know, looking at the markings is after."

Pitch is another integral part of the performing process as well. I work with musicians and especially singers who seem to always worry about their pitch and intonation. They fear that each note is not balanced with all the others to create a true sense of tonality. ED is a classically trained soprano who I have had the pleasure to work with many times. Her voice is exquisite and her performances are always meticulous. In my interview with ED she explained that the concept of pitch and its accuracy in performance was her primary goal. She spoke also of intonation and tonality which adds a sense of "home." All tonal pieces of music are comprised of pitches which create a sense of key or tonality. Music can be in different keys, but all tonal music has an inherent flavor, a center, one that resolves to a logical conclusion. This is highlighted most effectively in the European musical traditions of the 17th and 18th centuries where the dominant/tonic cadence was very popular. This V-I (e.g. G-C) created a sense of finality and is the most definitive cadence though eventually other cadences appeared, more subtle and nuanced. You do not of course need the finality of the dominant-tonic cadence to sense tonality but it does represent the most common in the early period, for this one leaves no doubt in the mind of the listener as to what is about to happen musically. ED uses this sense of tonality to accurately portray what she believes the composer intended by way of pitch, melody and emotion. She has used taping equipment so that she can go back and examine her accuracy with pitch and get a feeling for her overall intonation. We discussed what she looks for in performance regarding the concepts of pitch, melody, and tonality. ED says, "tonality, pitch ... Was there feeling? You know, when you're listening to something, it's different than when you're watching it. So I think recording is very difficult. I found going into a studio and making a recording which I did last year ... That was a very difficult process." In live performance, she explained, people very often know the piece and have heard it performed by consummate professionals, either in recording or in previous live performances. Therefore she, as the performer, should desire to accurately portray what the composer had in mind, pitch wise and emotionally with the knowledge that the audience is probably comparing her performance with the other performances previously heard. When performing live, the performer can demonstrate elements not readily recognized by a recording by using visual cues that are not necessarily inherent in the musical score or sound. ED feels that recording, "was a very difficult process because it's one thing for people to see

you, and they can watch your face and see the emotion. But when they can't see you when you're doing it in the studio, it really has to be almost over the top ... for me." In recording ED feels that the performance in terms of pitch needs to be even more perfect and emotionally charged than a live performance in that the audience does not have the benefit of visualizing the performer.

A musician I interviewed was a gentleman who was known as LH. LH was primarily a rhythm guitar player who specializes in a folk and blues style. As a rhythm player he was not always concerned with pitch and melody in the classic sense. He would be conscious of it and work together with the other musicians but it was not his priority. When he began composing he developed a deeper understanding of the importance of melody. As a singer he found himself more sensitive to the melodic aspects of performance. When he switched to playing bass guitar, he found that to be even more of a contradiction to melody, in that bass lines are percussive in nature and the least like melodic structure. LH says, "I'm very comfortable playing electric bass, but I find it very difficult to sing while I'm playing bass because playing bass is almost like a ... It's in part a percussive instrument, too, and time is everything with that instrument. And to sing a beautiful, flowing melody over the top of that is not an easy thing to do." Playing and singing two distinctly differing musical elements is a very difficult thing to achieve. The bass player works together with the percussionist, to keep the rhythmic aspect of the piece together and usually plays on downbeats, the melody however has its own parameters not constricted in this way. Each melody is unique unto itself. The two elements together make for quite a physical challenge when the melody is lyrical and the bassline more percussive. Once LH became proficient in this regard, he realized that he should try to attempt to play lead guitar. This type of playing utilizes pitch in an improvisatorial way creating musical lines and melodic-like elements . Someone who plays lead guitar needs to be very creative in making up these musical lines and tying the elements of the piece together. LH felt that he had become quite proficient at playing lead, "but as the years went by, it became something that I figured I should become a melodic player too. And I've become very advanced at that. I don't really make that the main thing, though. I usually find a way to figure out the melody on the instrument, also, besides vocally."

A way that some of these interviewees learned melodies and such, was the use of vocalization. It has long been known that people learn more quickly when the learning process includes a multi-sensory approach. Children read more efficiently for instance when they read aloud. In this way they hear the words aurally as well as through bone conduction. Therefore they are hearing it in two distinct ways. Singing pitches and melody lines also allow the musician to let the melody take hold in their minds for the very same reasons. Many method books that are used to teach young students encourage the vocalization process, claiming that if a student can sing it, they will be able to play it.

The musicians I've been writing about all have a keen sense of pitch. They can relate from one pitch to another, be conscious of intervallic relationships, and aware of harmonic structures. They would possess then what is known as relative pitch. This means that pitches can be recognized as long as a reference point exists. In other words, should the reference point not be given, their frame of understanding would be weakened and the sense of pitch name would be compromised. For the most part if asked what a particular pitch would be, without the reference note it would simply be guessing on their part. Ear training is an integral part of most universities musical training programs. The need to develop this skill is imperative to the musician because occasions for using this skill in a professional setting occurs quite often. This ability known as relative pitch is very common among most musicians.

As stated in the introduction, in 1 out of every 10,000 people there exists someone who does not need this reference point. Upon awakening in the morning if someone were to play this person a note on an oboe, or should the person hear a car horn or a bird sing, they would immediately know precisely what pitch is being sounded or sung. Should a child place an elbow on a piano thereby playing many notes at once, this person would be able to tell which notes were being played, where the bottom note began and where the top note ended. Many people have wished that they had this skill, and should you look in many music magazines you will find numerous offers to sell you a book or tape which supposedly can teach you how to achieve absolute pitch. One of the interviewees CC commented to me when I appeared envious that he had this gift, his response to me was, "well it is a gift most of the time, but how would you feel hearing crickets chirp and know that they are in the key of Ab. This gets

most annoying. Trust me, it isn't always a gift." Most researchers tell us that learning or acquiring this skill especially later in life is not very likely to occur. They tell us that people examined with this skill do have some definite similarities. For instance, most parents of people with absolute pitch are musicians themselves or who played music often around the house, even when the child was in the womb. Musical training would have begun at an early age, most say before the age of seven. Language ability is sophisticated and the person is generally articulate and bright. There are exceptions to the above as demonstrated in the example of the idiot savant who may have absolute pitch but not really have any cognitive understanding of this nor understand its implications in the field of music.

In my interviews there were five musicians who possessed absolute pitch. Two of these (males) were a part of the pilot study and so did not suffer any brain trauma. Three subjects (two females, one male) had perfect pitch. Despite the trauma to the brain all three still possess absolute pitch, though SC admits to not having the same amount of success in this regard. She explained that the second of her two brain traumas, which was an exposure to carbon monoxide, affected many of her musical abilities, mostly memory and her sense of absolute pitch. When asked at each interview if the musician in fact had absolute pitch almost all agreed immediately not without a sense of pride. Some musicians were a little tenuous regarding their abilities. The interviewee BM does not like to be asked whether or not he has perfect pitch. He stated, "the question of perfect pitch often comes up, and I generally hate to be asked that question because I've never been sure how to answer it ... because on one level I do believe that I have perfect pitch in that I hear pitches ... I automatically know what they are ... I hear them in my head. But it's not perfect." His reasons for this are stated above and have to do with the inaccuracy and lack of consistency between pianos. BM can hear notes in his head prior to hearing them and knows what they are, but feels that on occasion since he is off somewhat in his analysis he most likely does not have what experts would agree is absolute pitch.

Ana Maria is a very interesting person that began with a story of a promising concert career, an unfortunate accident and years of painful rehabilitation which has allowed her to be once again successful as a performer and teacher. The full account of her story can be found in her autobiography "*To Live Again*" (Bottazzi, 1978). Ana Maria has absolute pitch which was

discovered when she was two years of age. It seems that she had been reaching up and touching the piano as children are wont to do. However, Ana Maria immediately found middle C and began from this point to play a major scale in contrary motion, though as she states the scale was played with the wrong fingering. The literature that I have seen claims that absolute pitch comes from being exposed to music in a scholastic way when the child is young. It would appear that in Ana Maria's case this certainly fits with this thinking. Ana Maria says of this early period beginning at age two that, "I had to practice two hours a day until I was six, I believe. Four hours a day until I was 9. Six hours a day until I was 12. And 8 hours a day since the age of 12." One of the teaching techniques which Ana Maria's mother and teachers used and that she feels is important to the pitch process is that of the solfege system, which most musical educator's agree gives a definite tonal sense to new material as well as material known to the student. This is the "do-re-mi" system which assists students in hearing and then vocalizing a musical phrase, getting an internal feel for the various pitches and intervallic relationships thereby creating more advanced sight-reading abilities. Ana Maria grew up in Argentina where the moveable "do" system was used. In this system any note can be the tonic or "do". "Do" is the first note of the key that a piece is based upon. Therefore in the key of "C" the note C is "do", in the key of F#, the note F# is "do" and so on. This is an example of the tonic that was mentioned above, the tonal center or home. Some educators feel that you need to change the "do" depending on the tonality of the piece. Others insist that "do" should always be the note C. They claim that this is the way to achieve absolute pitch in that you are always used to hearing the note C as the tonality. The problem with this is that the tonality is dictated by the piece and its various elements not the least important is melody and harmony which may not be centered around the note C.

The interviewee CC concurs with AB. He also was taught through the moveable solfege system. Both CC and AB have absolute pitch and photographic memory. This of course is an incredible combination in any discipline, but especially that of music. CC's aural ability is highly sophisticated. He utilities his pitch abilities as an educator, conductor, and composer. The pitches that he hears have a certain rightness about them. For instance we spoke about absolute pitch and then trying to use a synthesizer which has the ability to transpose. CC is unable to use this function because when playing a particular note with the transpose function

on, he would hear a different note. The actual note he was hearing is in actuality different from the one he is playing. This he explained was impossible for him to do in that he would constantly reach for the wrong note in an effort to play accurately.

4.3 Auditory Memory

We live in a world of the senses. No person is exempt from this lifelong process and very little in the way of learning comes through any other means. All human beings begin in the womb to sense, feel, and react to sensory stimuli. Infants continue the process and react to various forms of stimuli; mothers voice, her touch, their own reaching for objects and try to make sense out of the world in which they are thrust. All that we know, all that we experience, and all that we remember comes from the sensory organs. Each of the five senses triggers the brain into action, relating and contrasting the current experience with that of past experiences. The accounts described in these interviews are the musician's interpretations of these sensory events. For the subjects, it is also a reflection on their understanding of the myriad changes and adjustments which occurred because of their brain injury. Each person has a unique relationship with their own apprehension of these events and their lasting effects upon the course of their respective lives. Memory builds on past memories in a complex evolutionary process while the person continues to observe, learn, and formulate his relationship with the outside world.

In this section of the thesis, we are primarily concerned with the hearing process, more specifically with auditory memory. We will examine how these musicians cope with auditory stimuli and how they utilize this experience with their memory skills all within the confines of their own worldview and understanding. How does a musician use his auditory structures? Is it the same or different than that of a layperson not trained in music? Should a musician experience brain trauma need he change the way in which he hears and listens and therefore memorizes?

In my interviews with twelve musicians it became apparent that each person had their own sense of audition and a belief system which allowed them to understand their own abilities in this process. Their ages and educational backgrounds are varied, as is their general abilities and musicianship levels. Each of them utilize their respective strengths and compensates for ascertained weaknesses. Some are strong auditory learners and so rely on this means of learning primarily, though not to the exclusion of others. Other interviewees attempted to be multi-sensory in their approach to memory knowing consciously or

unconsciously that memory traces are more likely to occur in a setting where more then one sense is being utilized. A few, as discussed earlier have the added ability of absolute pitch, while others because of varying difficulties have a relatively poor sense of pitch. LH for instance had a strong sense of hearing, however due to his trauma he is still undergoing rehabilitation in this area. "Yeah. As soon as I came home from the hospital, I started noticing that I was having a serious problem. In conversation, if my wife or daughter would turn their face or turn their heads away in the room while we were in conversation ... Or if ... You know, like sometimes people in your family will ask a question or they'll be answering a question, and they'll actually leave the room or just go around a corner. They assumed, of course, that I would hear. And it was dropping out. I wasn't hearing the same as I used to. And after a while it was becoming a sore point because they didn't understand that I was suffering from a problem here, and I didn't even realize it at this point yet to explain it. So after a couple of weeks of this, it was becoming a sore point. And I explained to my wife, I said, I think I'm having a problem with hearing because when you turn your back or if you start to leave the room, it's just dropping out for me. I'm not hearing your words at all. So I had a hearing test at a place where I was going for some physical therapy at the time. And they said it doesn't seem like it's regular at all. It seems like you've got a problem. After I described what happened (to the therapist), then she tested my hearing. And she said, you have pretty moderate to severe high-end hearing loss."

For LH, his accident caused severe auditory damage and since he relied on this skill as a musician, this impacted his life most dramatically. All auditory memory stems from the hearing process which, depending on intent and skill, will allow the musician to formulate strategies for memory. For some, this memory will be for mere pleasure and enjoyment, for others it is a virtual way of life in the realm of musical performance. Though the onset of LH's physical problems was due to accident which required immediate hospitalization, the severe ramifications of his injuries were not all obvious at the outset but took much time to become manifest.

In the case of SC her accident did not involve the anatomical auditory process in the same way as LH. SC did however lose the ability to remember and explained that it was primarily the short-term memory process which appeared affected. Prior to her accident, she

had excellent skills insofar as memory is concerned, but post trauma she had to come to grips with her inability to memorize as before. SC says, "Oh, yeah. Playing with music, I could play it. But ... yeah ... my memory ... Yet if I was trying to do something a whole lot simpler that didn't involve so much piano technique ... I could probably figure out or play a hymn, you know, something much shorter and concise in form." It appears that there is a most definite relationship between her memory and the complexity of the music. SC can figure out and memorize simple musical structures as in hymns or simple melodic and harmonic pieces, but the more complex the piece the more difficult the memorization process becomes. While this comment may sound apropos to the general population, it should be noted that at one time she possessed exceptional musical memorization skills where this ability was not ever questioned.

The interviews conducted give a sense of how musicians understand their ability to memorize and the processes involved. Most admitted that listening for them is the primary way in which they go about the musical memory process. The interviewee CC claims that for him, "The whole way that I memorize music is really just through listening. And it speeds up the learning process for me. I know how it should sound, and very often I'll try playing a piece ... before I even get the music for the first time ... just for pleasure. And then when I get the music I'll fill in some of the things that I wasn't doing exactly the way it was written. So it's already there. I'm hearing it, and I'm just kind of now putting onto the keys what was already in my brain, and I'm already processing, or have processed, that way." CC has the musical sophistication to hear and compare what he is trying to learn simultaneously. This unique auditory ability is enhanced and perfected by absolute pitch which he also possesses. When asked about his conducting choirs and using his auditory memory CC admits that he also hears the music perfectly in his head much like a tape recorder. "I'm more listening to the piece in my head, so I know which entrance is there because I've heard it. So I know the cue that should be there." CC compares what he hears in his head with what he ultimately hears aurally.

BM also has a sophisticated sense of listening and musical expertise, but he does not hear at the same time as CC does claiming that this would be too confusing. BM allows one hearing to pass and then uses his memory skills to compare the two. CC on the other hand hears the piece accurately in his head also utilizing his memory skills, but compares what he is

hearing already in his head to what he is currently hearing. BM says, " I hear simultaneously, I think. I don't hear before I play. That would be too confusing to me. But I definitely rely on my ears. No matter how complex the piece is, if I play a wrong note I can hear it." BM hears the music in real-time and compares this event with what he sees visually, whereas CC hears it in memory while he is listening in real-time and compares them.

There are many varied ways in which musicians experience music which depends primarily on their intent and their expertise. In terms of music and its relationship to memory, there are many similarities in how musicians strategize to attain their goal. As someone who has had extensive training there were very specific strategies taught, the most common of which is the intervallic melodic element and subsequent harmonic support. One of the musicians who was not traumatized by brain injury was CC who took many classes for ear training purposes where melodic and harmonic elements were explored. There were of course other ear training exercises taught as well, chromaticism, polyphonic, the polytonal among others. However, the primary was the simple melody with harmonic elements. CC hears in this way also, but with one distinct advantage. CC can hear and analyze both melody and harmony inclusively whereas most musicians need to focus on one or the other in terms of analysis. The reason for this is that for the average musician, even though they experience both in the hearing they are still two distinct elements, whereas CC seems to experience them as one. In other words he is able to chunk what he hears so that the analysis would be more of a one step process rather then a two-step process. CC explains, "much like Handel would do, he would have a single melody and then the chords would be supporting that. Unlike Bach, who would have all counterpoint going on. So Handel for me is a lot more relevant in that regard because it's just ... that's how I kind of experience the music ... a melody supported by chords. Yeah, it's all part of the same experience. It's so hard to separate them because it seems like it's all the same thing for me. It's just ... It's music. And it's just the way that I hear that ... I don't normally isolate the elements. It's almost like looking at the picture and seeing the whole forest instead of individual trees. Although there's a high amount of detail in what I do at the same time. So it's hard to separate the two." There was some curiosity on my part wondering how he would approach a more polyphonic piece of music and so there ensued a discussion regarding a Bach chorale and his ability to memorize this four-part hymn. Each line in a Bach

chorale is usually independent of the others and therefore is akin to having four melodic lines heard simultaneously. There will however still be a strong sense of harmonic structure and movement. CC was asked, "So if I played a Bach chorale ... an eight measure phrase of a Bach chorale with four parts, how many times would I have to play that, do you think ...before you could notate it for me?" CC responded, "I would say probably about four or five times. Because the first thing I would be listening for, without a doubt, would be the soprano line and the bassline, without a doubt. And I would try to fill those in as quickly as I can. While I'm doing that, I'd be aware of what kinds of chords that would create. Therefore, you only have certain choices on the middle voices. And then I'd try to really focus in on the middle ones. I would spend more time on the middle voices than anything else." The difference for CC is that a Bach chorale inherently is a more complex piece of music replete with melodic and independent lines, whereas Handel is more traditional in the sense that he uses melody with harmonic support. Since each line is independent it appears that CC needs additional hearings to complete this task as compared to a simpler exercise which may only require one or two hearings. It should be noted however that once CC has committed this more complex piece to memory he is still most successful even after much time has elapsed.

LH as stated before has had much rehabilitation due to his accident and for a few years was not actively performing as a musician. His first musical job, post trauma, was to perform in a show based on the music of the country singer Patsy Cline. The first step in the process was to audition which as can be imagined was a daunting task since his confidence level at this stage was rather low, as well as his recent knowledge and sudden realization that his hearing was not as good as it had been having been damaged as a result of his accident. To prepare for his audition, he memorized certain pieces as well as learning to perform guitar lines and solos which he had to learn verbatim off records and CD's. LH gives an account of how he approached this musical task," Well, the first thing I did was ... As soon as I knew that I was going to go for an audition, I went to the library and I found a CD of Patsy Cline's greatest hits. I brought that home and I listened to that for a week incessantly, and played along with it. I knew most of the basic structure of the songs, and I was familiar with them, since they were all hits of hers, like "Crazy" and different songs like that, that were big hits when we were kids. But I just played along with it for the most part from CD and then I made

notes on all of them ... different notes ... and I would sit and listen to different ... where there would be a guitar solo. And then I would sit down and I would memorize the guitar solo and learn it and play it over and over until I had those parts down. So when I went in the audition, I had a good touch with it already. So we went through it, and apparently they were very happy and very pleased with me. They thought I was the man for the job, and they hired me on the spot. At that point, what I did was I had brought a small tape recorder like this with me, which is ... I have with me all the time now ... I've been using that since the injury because it helps me keep track of things that I otherwise could possibly forget. So I taped the entire audition rehearsal and I had that with me. So I had that, plus I had notes that I had written as I was going through that audition, plus I had the CD of Patsy Cline's material. And we went through a complete rehearsal that day of the entire show, and I was pretty confident at that point. I had two weeks of solid work on my own, working on it at that point, plus the two full-length rehearsals, and all my notes. And my notes were pretty good because I had them all on big block letters I printed on legal pads, you know, and I kept them on top of my amplifier. And it worked out really well. The second night was better, and then the second weekend it was ... I felt really comfortable. And the fourth night, which was the second night of that second weekend, it was just fabulous. I was very comfortable after that. I did eight nights of shows, and as time went by, I got better and better, and I was playing more precisely the parts that I really wanted to play that fit, and I was taking out things that just didn't need to be there. So I feel as long as I'm able to work at it, you know, and I get that chance to work at it hard and work with my memory and make sure I have notes ... I did really, really well. I was very proud of myself, being the first work I've done in some time, being off the medication, the first work I've done after the medication ... It was a big step for me, and it made me feel really confident that I'm ready to go out and start performing." The above material offers insight to how a musician successfully approaches the somewhat daunting task of readjusting to a performance setting after being severely injured and after a long period of time has elapsed. His strength of character, hard work and a strong positive belief system in his ability allowed him this first of many successes. In most cases of traumatic brain injury, the physical problems compounded by the mental depression and anguish debilitate the patient to a great extent,

some of which never recover. For LH it appears that though much of this mental stress was manifest for years he was able for the most part to overcome this as well.

AB also has an impressive auditory memory having training which began very early. This training also included something AB considers very important to playing music, that of being able to sing solfege. Though she had a very severe brain injury, AB feels that this method helped her through her rehabilitative process and to relearn the piano. She says, "What I have now ... what I have been able to get back, let's say ... I have always worked with many memories. I have a tremendous ear memory. So somehow you hear how the music goes. When I was young, I had a tremendous training, which very few people ... I'm more and more amazed when I see people that I consider my equals cannot do what I do. I don't know if you know, we say "do re me" in Europe, South America ... We say "do re me fa so la ti do" as opposed to ABC. I can tell you , because I was trained to learn that ... All the notes of any piece ... For instance, (she's singing a song) ... So that is something ... People can't do that. They do (she's humming) ... They don't know which note it is." At her interview AB demonstrated this ability. She solfeged a piece she was working on, with total confidence and with perfect pitch and at a tremendous rate of speed. This system of singing for non-singers is a strong one in certain educational and musical settings. It is used in young children who are learning an instrument and proves to be a strong tool for this process. The process works due to the fact that when you hear a note exposed in more than one sensory mode, learning has a better chance of being achieved. When you sing you hear the pitch aurally as well as hearing the pitch through bone conduction. Therefore one could assume that this system would also benefit those who are brain injured as a strategy.

JJ, another professional musician had similar ideas on how to memorize and concurs with AB. His teachers taught him that if he could sing it, he will be able to play it. Though now he primarily plays bass, this technique was taught to him while he was a student of the cello. JJ says, "And the other process was I would sit with the music and a piano, and learn the music and sing it. For example, like learning the Bach solo cello suite, the teacher said, before I would play it ... You know, play through it once just to hear it and then sit down at the piano and sing it ... be able to sing it through. So I would memorize it ... learning it like a song. And then go to the cello to play." JJ does not try and learn something visually, as he stated at our

interview, "It's music. It's not painting. It's music." JJ's belief is that if you want to learn sometime auditorally, why would you approach it with a different sensory thrust. His method is described as follows, "Like ... I play through a piece of music once, and then close the book and put it on the other side of the room and just try to remember as much as I could ... play through until I could not ... Yeah, try to play as much as I could and then when I couldn't remember it, I'd go over to the other side of the room, look at the music. Because my old teachers told me to do this. And then look at it without playing it and go back and try to do it again from memory.

The need for a strong auditory memory for musicians is quite clear. To be Successful, this is an imperative skill which needs to be learned, utilized often and strengthened. You will find in this thesis musicians with strong auditory sense and those without. Although most of the musicians written about here utilize their visual sense at first when studying a piece to be memorized, some had to rely on their auditory sense because visual memory was so poor or even almost non-existent. An example of this is CCT who was born with poor visual memory. Although she and her teachers knew this condition existed, it was only when she experienced her stroke that the reason for this inability became manifest. While working with her piano teachers over the years they together realized that she would not be able to memorize visually, so they taught to her strength, her auditory memory. CCT explained that her visual memory for music and even for language was always poor, so one day her piano teacher began to approach this process differently. She says, "I mean, what Edith stopped doing when she realized that reading music just wasn't happening for me was ...She had always played the piece for me before I would actually say, yeah, this is something I want to learn. But she actually stopped doing that because she wanted to try to get me to read it, but that didn't work. So she went back to playing it for me. And even if, like, I was playing a piece and I messed up, and she just played that measure that I messed up on for me, I could basically clear it up because I could hear what it was supposed to sound like." CCT considers it a blessing that she is able to utilize her auditory memory and to this day claims that it is possible for her to recall pieces she had learned as a child. "I like playing, and I've basically memorized almost everything I've ever played since I was 8 years old."

SC also possesses a fairly decent auditory memory. She had explained that if she was playing a piece that she had learned, and was having a bit of trouble remembering, she would call her auditory memory into play, where she would try and recall what would happen next. She would examine the melody, the harmony or the form to ascertain the next strategy. SC explained, "Well, when I'm trying to remember something that ... Like if I'm in the middle of playing something, I can hear where it should go, and I can see, you know, the notes that I should be playing next, kind of thing." Auditory memory for a musician is so important to success. To quote one of the interviewees who has close to perfect auditory memory CC says, "Yeah, whenever I turn it on ... (it's like)turning on a switch."

4.4 Visual Memory

When attempting to memorize music it would appear that there are two primary systems or strategies that are utilized by interviewees in this study. These primary systems are the auditory and visual. It is through the input of these two sensory methods that most of what we remember is accomplished. In this section we will examine the interviewees' understanding of how they view their visual memory. In most cases a formal decision is made to memorize music, and more often then not, they utilize visual strategies in a similar way that they would in memorizing language. A student who needs to memorize a speech for instance, would usually use a copy of the text to do so. It does not appear likely or occur often that someone would use a recording of a speech as a vehicle for memory, though it cannot be fully discounted. From my experience however, and in the interviews conducted, information gathered would lead one to believe that the primary way to music memory is through reading, practice and repetition. It is true that some of the more sophisticated musicians use auditory memory for this also, but all of the interviewed musicians use visual memory at one point or another. For the younger interviewees a typical scenario would be that a teacher would provide music for them from which memorization would be sought. The students would have a weekly lesson and spend time during each week trying to achieve some success at memorization and to prepare for the following week's tutorial. The instructor would then base future memorization strategies dependent on their student's continuing success at memorization or lack of it.

Although CCT had reading difficulties due to her physical problems and preferred learning things auditorally, when initially learning a piece she would still rely somewhat on her visual skills. This would happen of course when her teacher was not present nor a recording of the piece. Her tutor was not initially aware of any shortcomings until some time had passed and she realized that CCT was not able to learn in a visual way. "Yeah...I can't sight read. And then I'd probably try to put together the left hand, and then try to put them both together. It would take a really long time, but....measure by measure by measure." For most professional musicians, as skills increase and musical and aural abilities become more sophisticated, auditory memorization will occur more frequently, but for CCT in the realm of her reading problems made reading music as well as language a nightmare. In this next

passage she refers to her disability and references how this impacted her schoolwork and created a stressful environment when she was required to read music. "So I had somebody with me all the time because I had visuo-spatial and severe orientation problems. And they also had to reformat their tests because of the visual spatial problems. And I never learned how to read music. Speaking of music, I've played piano for nine years. I play by ear. Well, I can't reproduce, but if I heard it ... And I can memorize. So I would learn measure by measure by measure and then just put it all together and eventually have a piece. But looking at notes is just horrible for me."

In the case of BM, who explained that he does not rely on his visual skills at all to memorize. "I don't relate to music at all visually. I don't ... I read that Rubinstein would look at a piece of music and it would be in his head, and he would literally sight-read from his brain. But I have no visual connection to music at all." Although BM claims that he does not relate to music visually, the pieces that he was memorizing were so advanced that relying solely on the auditory was not always feasible. Therefore, while he concludes that he does not relate to music visually, he does almost always begin the learning process with the visual.

JJ also prefers not to rely on visual at all because as he put it, "It's music. It's not painting. It's music." JJ uses a system of 'chunking' to assist himself in memorizing music. "Yes, because one thing that you're memorizing ... one chunk ... stands for a lot, as opposed to each individual note. Because then I'm thinking ... I'm not thinking, like, you know, D minor G7 C ... I'm thinking II-V-I. And that's a whole chunk. Like when I would teach, I would talk to my students about that ... about when I look at a page of music, I don't look at a page of music and read OMNIDIRECT
(he spells out the letters). I look at it immediately as OMNIDIRECT (he just says the word) as opposed to ... So I try to make my memorization into that ... seeing things in chunks. So II-V-I is not three separate things. That's like ... II-V-I is like one chunk." Being able to see musical patterns is a skill that one acquires as a person gains expertise. The knowledge that one has for the melodic and harmonic patterns can give valuable insights to how a piece is structured and will ultimately make it easier to memorize. CP prefers auditory memorization, but still relies heavily on visualizing a piece especially if the thrust is memorization. In this section of our interview CP is discussing having to memorize a piece of music from "Cabaret" for a school

event and not having the music or a recording. Since he had to use his auditory memory to recall the piece, he felt that this for him definitely slowed down the process. "Yeah, and I hadn't done it in a long time. I had to practice a little bit. So about a week because I had to play it without the music. "It would have been a little easier for him if he were able to listen to it. I don't know, it might not take me that long, you know, if I listened to it."

Likening it to a muscle, BM indicated to me that any musical skill needs to be used so that it does not atrophy. Using memory skills in music needs to be challenged and strengthened just like any other skill. "Within music itself there are so many skills ... so many things that you can be called upon to do. And I've found throughout my career that as you use one skill, you have to constantly utilize skills or they diminish in quality. So that if you're in a situation where you have to do a lot of sight reading, your sight reading improves, but at the same time your ability to perform pieces by memory ... because you have not been practicing that much ... that diminishes. If you find yourself in a situation where you have to do a lot of instant transposing ... The more you do it, the better you get at it. If you go into a situation where you're away from that for a while, you start to lose that skill as well. It's like ... the memory is like your muscles. It's like another muscle. It's a use it or lose it situation."

Some of those interviewed possess a very sophisticated memory in which memorization can occur even when unsolicited or undesired. In other words they can remember intricate details that occurred in times past, or remember with conscious effort current memory undertakings. The interviewee CC is a personal friend of mine, and we have had numerous informal conversations regarding his almost infallible memory. On one occasion when discussing this, he demonstrated his ability by describing to me in great detail the house I had lived in five years earlier and where he had only been on 2 separate occasions. He was still able to explain the layout of the house, the colors of the décor and where specific objects were located. Here is part of the interview where we discussed this topic. "No, it's just there. I don't know why. It just is. I remember your old car that you used to drive ...you know, Patty's white car, for example. You know, little tiny things about the whole thing. How to get places after I've been there only once ... trying to find my way back. Because I make an image in my mind of what it should look like. And if I have a model to work on, you know, I'm a visual learner. And I could even do that with the music sometimes. I could make a map

in my mind as to what should be happening next in the memorization process. If I'm trying to get to really make it a point to memorize a piece, I could start putting a visual map in place as to what should be next ... arrival chords ... and I'll have an image of what the chord will look like somehow in my mind ... or sound like." CC intimates that in the instance described above there is not always a conscious effort on his part to remember these details. He did not attempt in a conscious way to remember these things, they just occurred on their own. CC uses the words "It just belongs there" quite frequently. For him it is like there could be no other place for an object to be found, because this is where he has seen it, and remembered it. There is this sense for him that it just belongs there. In terms of music, CC has the ability to visualize the score in his mind, down to the page numbers. He does state however that these memories do not last as long as what he remembers musically. In a musical setting he explained that musical items could be there almost indefinitely, whereas these items of visualization can disappear over time. "Well, that's interesting. Because I could tell you exactly what page everything's on ... the way I can remember the ... you know ... the way I can remember the model of your old house. It just ... It belongs there. So I know that that's probably ... I know that's the last measure on page 7 because that's just where it always was. So they'll be ... If I want to make it a point to think about it, they'll become inseparable also. Those two thoughts. If I decide to think of it in those terms. I don't usually, but if I am, I know that that's the page turn. I know that that's the middle system on page 4. It's just the way I start to think of it after a while. Those kind of memories last less lengthy than the musical memories themselves, though."

ED appears to also have this ability of seeing a page of music in her mind. She apparently can visualize the physical page and associate this with what the particular meaning of the piece might be. "Oh, this is the most important thing, I think, because I actually memorize or keep in my mind what the notes look like on the page. I visualize the page. I learned this in college, and it's been a great help. I'll be standing in church with maybe an exceptionally long passage, and I'll think of what it looks like on the page. It's definitely visual for me. I do learn, you know, the meaning of a piece ... what it's saying ... but a big part of it is the picture in my mind on the page of what it looks like.... I can see it. I can see all the pages. I can see the numbers at the top of the page ... page 2, page 3, page 4 ..."

For those musicians who have experienced brain trauma there appears to be a conscious understanding that they should not depend on one particular sensory system of memory, but strive to use a multi-sensory approach if possible. Ana-Maria who had severe brain injuries was the most articulate in this regard. She uses almost every mode that she can to try and memorize music. In this passage she refers to her visual memory as her primary method and the use of this in everyday life, "You have that feeling of seeing what you are doing. You know. It would be like if you have the music ... it's like you really have the music in front of you. Also, I've read many, many very good books when I was young. One of them teaches you ... Like if you say to me, don't forget when you pass downstairs to get the mail. As soon as you tell me that, I see myself passing the mail four or five times in my mind, and picking up the mail. So when I go there I actually remember that and I do it. And I don't forget. That's one of the things I learned as a child. All the things help me. You know, I have a handicap but I have many things I use.

4.5 Kinesthetic Memory

There is a fascinating aspect to memory which almost all people take for granted. We are very aware and conscious of our visual memory and auditory memory but not always aware of our kinesthetic memory, yet we ride a bicycle, drive a car or play an instrument as some would put it, "on automatic pilot." Kinesthetic memory does not depend on our cognition and therefore is not on a conscious level yet we are able to perform sometimes very complex motor tasks seemingly without formal thought. How is this possible when we know that we were not really concentrating on the task at hand? How do the hands, feet or fingers know what to do sometimes with complicated movement, in a particular order and sometimes with subtle fine motor nuances? The brain organizes all sensory experiences and stores them for future reference, that is unless some form of long-term decay set in due to neglect and the effects of time. Therefore, the sensory organs will respond to the brains indication that some muscle movement must take place, all without dictates of the conscious mind. BM agrees that we have and utilize motor memory in many aspects of daily life, "I think we all have motor memory in anything that we do. For example...Well, anything, like riding a bike is a matter of memory. Working a clutch on a car...if you drive a stick shift. There are a lot of things...typing, of course. There's definitely motor memory at work in so many things that we do with our hands."

One of the interviewees had an insight that I believe is most important. To understand it, one must look at his comment as a musician seeking insight from another musician. The statement is rather profound and yet is easily understood. CP is a saxophonist who is primarily a jazz player and was referring in our interview to Charlie Parker, one of the all-time great players. CP was relaying what he experiences regarding fingerings on the saxophone while playing songs written by Parker. "But there's a few things...like I know exactly...I could play them easy because I know the feel. Certain things...[hums a little]..I know that right there." What he knows "right there" is a certain kinesthetic reference that just feels right. It is a kind of bond between the two players through the music that they both have played at one time. It is an uncanny sense that there is a feel from one particular note to the other in a melodic way that is natural, that it is perfect. When CP made this statement he was holding an imaginary saxophone in his hand and while humming the rather complex be-bop tune Parker had written

was able to execute the piece at our interview though he admitted he had not played it for years. What was it that allowed him to recall something from the past that was so intricate? Researchers tell us that time is the strongest of enemies against memory and yet CP was able to remember this musical event some years later. There was a sense of excitement as CP explained this to me, and made you feel as if you could almost visualize Parker writing this with his horn in hand. The continued dialogue went as follows as I commented, "You know what he's doing. You can almost feel his fingers in yours...doing what he's playing." CP responded, "Yeah, exactly. And also, when I do write down...sometimes at the keyboard...Sometimes I will find myself...doing the horn a little bit. Yeah, that I can feel." The concepts above are interesting. CP is a saxophonist and not a pianist. He can feel what Parker was doing, not on the piano but on the saxophone. He agrees that his fingers and Parkers were almost like one because of the flow of the melody and the muscle memories relationship to this.

CP of course is not the only musician who experiences this. There are times when playing a Chopin Nocturne for instance when the notes of a particular run just feel right and very natural. This is more easily remembered then other portions of the same piece which do not feel as natural. It is as if the fingers know where to go, before any formal thought is in place. There have been occasions in my professional career where I would be playing for a somewhat disinterested audience and would allow myself to play on "automatic pilot." Inevitably someone would approach me and ask what the name of a particular song was. I had to admit with some embarrassment that I really did not cognitively remember what song I had played. LE says, "When you just put your hands down and you play and you never really think about it. Your hands kind of just play it." When asked about this muscle memory LE agreed that she does "use a kind of kinesthetic...in other words, how the keys feel playing a certain chord or run or something...you're looking at patterns, or you're feeling patterns, rather than thinking notes." LE it should be noted is a very bright young woman but not a formally trained musician in terms of university work. Do other untrained musicians follow LE in terms of this kinesthetic sense of motor memory?

CCT is approximately the same age as LE and is also untrained in a formalized setting, though did study with a tutor for a few years. She appears to be of the same mind as LE in this

regard. CCT has experienced TBI and has many severe problems in terms of visual memory both for music and language, and claims that because of this she has compensated in the auditory and kinesthetic senses. "I can play pieces with my eyes shut. I can play pieces blindfolded. I can do that. Because...I can dial a phone without...because I know where the keys are. And actually...This goes along, I guess, with music. I know how the button sounds when you press it. So I'll be sitting in the kitchen with my dad, and if the phone goes [makes the sounds], I know that he's dialing my mom because I know that that's 928-2180. And I actually know the sound. That's just my own quirkiness." When asked to explain this self-awareness, she used almost the same words as LE. "The fingers just know where to go."

For trained professional musicians it appears that kinesthetic memory is still a very important aspect of performance. BM feels that in performance settings when stress levels are high, you need to have strong kinesthetic memory in case of memory failure. "The mental stress can cause you to have all sorts of memory lapses. So that's where the motor movement becomes very , very important. Because you have to be able to perform the piece...When you mind has gone completely berserk due to the adrenaline rush and the nervousness, and so forth and so on."

BM studied in France and reflects on these days and the utilization of kinesthetic memory, "Well, I think it takes a certain amount of patience. I was always so impressed...I studied in France for a year, and I found out that their word for "rehearsal"...the French word for "rehearsal" is "repeticion"....repetition. And that I think this...more than anything else, a matter of motor memory. You just do something until you get used to the feeling of doing it. Shooting baskets, you know, hitting baseball, whatever. I think it's all a matter of motor memory."

Ana-Maria is the most well-trained musician I interviewed, having earned two doctoral degrees. She also is very aware of muscle memory when she plays and in fact relies on it. "My technique uses a lot of muscles....So the memory of the muscles tells me to play. So it's the knowledge of the piece. It's the ear. It's the brain, of course. It's the looking at. It's the muscles. It's a lot of memories that bring back." For Ana-Maria it is also a strong case for the auditory since that is her strongest sensory organ, but apparently relies quite heavily on her kinesthetic memory as well. BM is in agreement, "I think it's a combination of the physical

memorization in the fingers and ears." In terms of memory however even though trained as well as untrained musicians rely on muscle memory, to reach this stage it still is practice and playing a passage or a piece over and over again.

Ana-Maria's brain trauma caused multiple problems in her sense of touch. She spent years learning a piece of music with certain fingerings, but post trauma the brain was sending the wrong signals. Although she knew and remembered which fingers to use, she found herself using wrong fingerings. "Because I wanted to say use 1, 3, 5. I would use 4, 2, 3. Never what I want to. I felt very confused, like the brain was giving the order, but it was a place I don't hear...where it will not go through. You know. So I could not bring down the finger I want to bring down. I want to bring down this one, but the other one would go down...the biggest thing was to bring down the finger I want to bring down. Now, which scares me to death, once every six months or something, suddenly I'm playing at home or whatever, and suddenly I cannot do something, you know."

The subject SC is a friend and student of Ana-Maria. In my interviews with SC and Ana-Maria we dialogued about the ways that they had strategized about to overcome this problem where the brain tells the fingers what to do, but the response is inaccurate or noncompliant. Ana-Maria uses a technique that addresses this. A phrase will be examined which has a particular set of articulations or rhythms. This phrase will be played over and over again using differing articulations or rhythms. In other words if a musical selection is very staccato, let us say a run of sixteenth notes which go for eight measures, Ana-Maria will approach it and play it in triplets, or she will change the articulations. She might take that same phrase and play it over and over again but totally opposite from the intent of the composer and play it legato. She will vary this in as many ways as she can determine. It is the repetition of the playing which allows memorization to occur, but it is also the allowance of playing it and hearing it in differing ways which assists in the process. The varied ways of rehearsal cause a link to occur between the fingers and the brain according to Ana-Maria.

SC uses this technique when she practices. In our interview SC stated, "Well, Dr. Bottazzi taught me a lot of ways to help with that. And I was studying with her before I had my second head injury. So it was interesting to see how that process helped me before the really traumatic head injury...the second one. A lot of what she taught me was motor memory

and just going through phrases and using different rhythms to just get them into your fingers so you can just sit down and play almost without really processing what you're doing. Your hands just do it. Your whole body just does it." Later in the same interview SC tells me that, "I know that having worked with Dr. Bottazzi, she also told me to...whatever I did with a piece, do it all the opposite way, and don't get so caught up in one way to practice something. But that was for your motor memory. Like if something was supposed to be legato, do it staccato, and vice versa...because that would really get it into your...you would really know it them." Ana Maria explains, "One way is I do a lot of rhythms. I change rhythms. Like I take a piece of music...a page...and I see the page as if I only see black..like if there were just all black notes, with no rhythms. And I use 20 different rhythms, and I play the piece 20 different ways...the page. And then I go to the next page and I do...I try to do that 15 times, the 20 rhythms in each page. Usually after I do it five times I know it by memory...the piece. However, by the same token, I am very...like I do a map...I do these two times and it goes up. Like, very intellectual, nothing with music. You know, I go twice here....and then, I don't know, it reverses to here. And I get a map of the piece in my mind. You know. When it's hard to memorize, I really kind of learn the map of what I'm doing with my hands."

It is fascinating that in these interviews there is an almost zen-like approach to using kinesthetic memory. The conscious mind appears to be a hindrance rather than a help. It is almost like the writings of Betty Edwards who uses a technique to allow supposedly inartistic people to draw, all by learning to see properly. Edwards says, "The magical mystery of drawing ability seems to be, in part at least, an ability to make a shift in brain state to a different mode of seeing/perceiving. When you see in the special way in which experienced artists see, then you can draw" (Edwards, 1979, p.3). The claim of Edwards is that in drawing there is a shift from the planned and logical left-brain to the intuitive and creative right-brain. It would appear that the same thing occurs in music. For myself there does occur a freedom and fluidity of movement which occurs when cognition is abandoned and allowing the kinesthetic to reign. This of course occurs only when the knowledge already exists. There needs to be the learning process first and then learning to allow the kinesthetic memory to surface.

LH says, " I'm getting more feel. I have better feel as I relax more. So some of it is going from the brain to the touch also ... because I feel that I have a better, more fluid touch on playing melodic guitar than I ever have at this point." This statement occurred in our interview where he was referring to having learned some music so well that it had become a part of him, where he did not have to think cognitively in performing it. JJ talked of a similar experience when he works in a band, "I know what you mean. Like if there's a run....that's a category of a scale...yeah, there are patterns that I work in that fall under my hands, and oh, that's just like a major scale. I'm not thinking of the notes."

For a consummate professional like Pat Martino these physical memory cues are still so very important to a successful performance. Again, the words "it just feels right" comes into play. Pat says, "But in terms of the structures....the architectural structures of what's setting up the themes, in many cases the themes that I write are...they're dividends from improvisations...whole improvisations. And they do contain...they do embody certain physical positions that are memorable. You know. And maybe it's that...the fact that they are memorable that they feel right...that I could maintain that. And prior to the performance that's what I retain more than anything. And that particular composition obtains that solidarity...through that." Pat uses improvisations to write new material. Improvisations, by their very nature are spontaneous and unplanned and occur without conscious thought, though they will always stem out of what one knows and understands cognitively. These improvisations have inherent physical movements which are comfortable to the player and that give a sense of rightness to the creative outburst of melody. It appears that when using kinesthetic memory, these memories can be called upon quite easily and with great success as in the above dialogue with CP.

Another interviewee CC finds the same thing with kinesthetic memory. "Sometimes years later...I haven't played a piece in a long time...sometimes even years later I still have the tune in my head and I find out that if I start playing it even without the music in front of me, it translates somehow into muscle memory....for my fingers. I just find that I'm doing the right things because it's kind of already tucked in my ear and it forces my fingers to kind of remember it. Because I'm just basically uncovering

what's kind of still there. And I have the basic tune already in my head, so it's just kind of...The details are just kind of fleshed out when I play it. But the basic tune is already there." We dialogued a little further where CC talks a bit about the intuitive side of kinesthetic memory. "There's almost a sense that my hands seem to intuitively know what to do if I have it in my head. If I've forgotten little stretches of it...little segments of the piece...my hands almost seem to have a memory...a muscle memory...of what to do. And it's drawing its information from my ears, and it just kind of happens, and it just seems to fall into the right place. I guess if you play something often enough, and then you put it aside for maybe a year or two, you've done it so many times, there's a certain memory that comes from that...that the muscles just seem to want to do on their own.

4.6 Methods of Memory

We have been discussing how musicians interpret and understand their own memory and have gathered some insights from the interviewees to explain this process. However, even though visual method may be the most utilized as a means for musical memory, the strategies employed to attain the goal of memory can be diverse. Are there similarities in the way musicians use their visual memory and approach the task of memorizing? Would a musician instinctively attack a project of memorization in music the same way they would for a language related task? It would appear that almost across the board, the typical way in which someone approaches memorizing music is to break it down into smaller parts. This is sound reasoning for any large project, to take the whole and to see it as smaller more manageable units. This again is analogous to language where someone would memorize a speech for instance, by reading it word by word, sentence by sentence and repeat it until a consistent accurate memory is established. The interviewees all agreed in this study to some degree that a musical piece would be broken up into musical sentences, notes, measures or phrases. They in essence also agreed that smaller units of memory are preferable to larger units. A consistent theme with both language and music is that the person attempting to memorize looks for an understanding of what they are memorizing. In other words the task of memorization becomes much easier when a sense of the whole is attained. It is in this way that a person can see where this one piece fits in overall structure. One difference between memorizing music and memorizing language is that music includes other elements i.e. dynamics, articulation etc. that are an integral part of the music. Language on the other hand, while it may use some inflection or utilize an exclamation point or question mark, these elements are almost built into the way the sentence is phrased. It is inherent in the sentence structure and is made manifest as you read, at least in intention. In music, these related elements do influence the execution of the musical phrase as in language but is not always apparent or identifiable in the way the musical sentence is built. There are some occasions when these musical examples are obvious, but a composer can write a crescendo wherever he wishes or write articulations different then what the performer might have envisioned.

A large percentage of the music discussed at these interviewees can be found in the basic repertoire of a pianist or in the case of ED, a vocalist. The pieces which are in each

person's repertoire is primarily tonal music of varying degrees. When there was mention of atonal music, the criteria for memorizing this quickly changed by making the units of memory smaller. In tonal music, phrases could be chunked easily, whereas with atonal music smaller units would necessarily be memorized. An example might be a measure for atonal music as compared to four-bar phases in tonal music. The interviewee BM says of this, "Actually, I have a real method for that. A long time ago I used to just play a piece until I had it memorized. But I think some time in college I started breaking it down to where I literally memorize a piece measure by measure, depending on the complexity of the piece. If it's a Mozart sonata, I may memorize a four-bar phrase at a time. If it's say, a Schoenberg piece, I may memorize by each measure and just work on one measure until it's in my memory, and then go on to the next measure, and methodically work my way through a piece. I've found that it works very quickly for me. I can memorize a sonata in a matter of two or three days." BM then, has a very definite plan and strategy for memorization and has worked it out very methodically. He does not use a form of analysis when he memorizes so although he is most definitely aware of it. BM claims that while he finds it relatively easy to memorize it is very slow discomforting process. "No, actually, what I do is very pedestrian, and it's a very painful process...I mean it's really rough work, but it's so fast."

In the case of CCT, her reading skills were so poor that when she did attempt to memorize a piece using her visual memory she would use a very deliberate and slow process. "I have to go measure by measure....starting right hand, then left hand, or left, then right. And then just putting that together. And then once I have that measure, I can move on to measure 2. And then put them both together. And then measure 3. Then I'll have three measures of the piece. I have to go measure by measure by measure." JJ on the other hand who is a cellist/bassist tries to get through a longer phrase and really focus on the melodic aspect. "....an eight-bar phrase, maybe....I would do it melodically first...something cello. Of course, you want to know what's going to be happening in accompaniment." As stated elsewhere JJ is also very aware of the assets in chunking, and sees a melody in terms of motifs which then can be put together and examined in light of what the broader picture looks like musically. "Yes, because on thing that you're memorizing...one chunk...stands for a lot, as opposed to each individual note."

There are those who look at a musical piece to be memorized as a complex tapestry of intervallic and harmonic relationships. For my own memorization I rely on my background in musical theory as an integral part of my process. In a way for me, there is a viable understandable method when I can sense a pattern in the harmony, in particular inversions of chordal structures, or a sense of melodic contour.

SC approaches memorization this way also. She says, "But I would go through...I was always interested in analyzing the chord structure and the whole structure of the piece form-wise. And so I would always do that. And I always knew where it was going key-wise, and things like that. So I think that really helped me a lot. I was probably...you would say I was pretty scholarly about how I memorized things. And now I have to be really conscious of what's going on, and I have to be thinking of the harmonic structure....and sometimes the phrasing will help me to remember certain parts...or the touch."

The interviewee Ana-Maria uses a more instinctive approach. Since she is very well versed in analysis and musical structure it is more intuitive in her case. She does not have to think that this is an Eb chord, she just knows. Here is a short passage on what she thinks regarding this, "I mean, I know where I am...harmonically....but even this morning, I have a student who came for a coaching lesson. And she gave me the music, and I was looking. She wrote, Ab measure, Eb measure, whatever...That has never helped me because I don't need to remember it's Eb measure. I cannot know it. Also, I'm thinking everything not in my mind. You know (she's humming fast)...so I don't need to know. I don't need to think, you know..." When a piece of music has been memorized thinking about the smaller details will ultimately distract you from the flow and slow down your performance. It would be akin to an actor who has memorized a monologue and suddenly tries to think of every word as he is speaking rather then to trust the process of memorization and allow the words to flow. Half of the interviewees are pianists and we can see that for all intents and purposes the strategies for memorization have very similar elements. Three of the musicians however are guitarists. For LH who is a folk-blues guitarist, his focus in memorization quite naturally is chord structure and rhythm. "My orientation....it usually starts with...It's got to start with a chord patterns, which would be rhythm on guitar. I've always been...I started out being a strummer, which is a chord player, which is the basics of the instrument. ..I'm much more comfortable, and it's always

been this way, to play rhythm guitar and to play perfect rhythm, know exactly where the changes go and the timing in the whole structure and sing the whole vocal way through."

Pat Martino mentioned in our interview that he, even at his advanced performance level, needs to reduce complex projects into a more simple manageable structures. His is a more esoteric view of what others are saying in these interviews. He speaks about his trauma in the following excerpt, where he creates a world-view that demonstrates his understanding of the importance of simplicity in life. There are many philosophical points that Pat has made which makes one sense that he does indeed internalize these ideas and allow them to be made manifest in his life. During our interview he expressed his view that his trauma which caused an incredible amount of anguish for him, needs to be embraced and not thought of in a pessimistic way. "Well...it's...for me...again, simplicity is the most important thing in my...more or less to amplify ability on my behalf. If something is difficult for me, I'll find the simple part of that complex problem, and I'll try my best to reduce it to simplicity. A good example...All that I went through with regards to recovery and ...at this point in my life, looking back upon those moments of crisis...I could see that in a very pessimistic way, and say, "Wow, I really had to go through a lot, and I'm really lucky to be, and thank God it's all over, and now I'm living a more happy life. I prefer not to see it that way. I prefer to see that as a necessity...to be here as I am in this present state of thinking...of perceiving. You know. So I see that it a very optimistic way. That simplifies all of the problems that were involved in it. I see everything as here and now, and everything that has taken place I see equivalent to the reason why here and now exists. So I'm more pleased. You know...It's more pleasing that way." Pat works very passionately in his performance and recording career. The thoughts expressed in the above quote are exemplified in the way Pat approaches his music. His skill and performance level is incredible, and he is well known as one of the top jazz guitarists performing today. It is obvious that he, in his quest of musical perfection, incorporates the philosophical ideas he has expressed to me and applies them to his personal life as well as his performance career.

As stated before, musicians have much more than notes to contend with. There is style, interpretation, dynamics, articulations and the like. A part of my questioning included these areas and elements of music and their importance in the overall design of memorization. In the

section on melody, it was established that, at least for my interviewees, this was the most important part of a musical piece. Since the melody in most musical pieces is found in the pianist's right hand, does it then stand to reason that pianists work on the right hand first, or do they approach this as a total musical project and utilize both hands? When in the process of memorization, are the other elements considered? Do they worry about learning dynamics for instance at the same time that the melody is being learned? BM is conscious of the elements but this does not command too much attention for him in the early stage of memorization. "The notes and the feeling. And I think I would pick up a lot of the articulation and dynamics and stuff as I do it. But that wouldn't be my focus. I'm a little bit not too detailed as I memorize, and the more I learn the piece, the more I think, well, maybe I should pay a little more attention to what the composer wanted."

LE tends to look at the melody first, so she begins with her right hand playing it over and over and then adding sections. "I would probably start with the right hand...usually the melody, just to know how the song goes. I'd try playing through as many times as I could. Then I'd go to the left hand to get a feel of that. Then I'd play them separate several times until I was comfortable. I'd try to put them together and then I'd break it down into sections, playing them together until it went smoothly." Another approach is to use both hands initially, this way both melody and harmonic background are learned together. Notice that LE sees the melody as just the right hand, and of course she is not mistaken, whereas others hear the melody and harmonic support as one element as in the case of BM. "Again, it depends on the complexity of the piece. But for the average...Mozart, Chopin or something like that...yeah, I would work both hands." LE appears to need more time then the others in terms of seeing the bigger picture. She takes a little longer to see the whole as she works through the piece.

CC on the other hand hears a piece in his head while he is reading it. Therefore all the elements are present in his memorization. He finds it difficult to separate these ideas since he hears them in his head. In other words if there is a particular articulation pattern, this is what CC would remember. Other musicians find it necessary to look at the various elements separately and then eventually put them together. CC says, "It's hard...I just find it hard to separate any of them. They just seem to all go together. It's just the way it should sound. There is not other way. In this piece, that's the way it's written, so that's the way it should be.

It's just...That's just the way it is. It's not always an F, but it's playing staccato. It just is. It's just the way it sounded, so that's the way it should be. You know, especially if you have a recording and someone has a preconceived idea before, and you're listening to it. So now if I were to try to play something that I heard someone doing and I got the music to, there would be not way...even if it wasn't written in the music that way. If it was a sloppy job of editing, and they didn't write that F staccato there, I'd still play it that way because that's what the guy did on the tape." The preceding paragraph demonstrates to me how much of an aural learner CC is. He clearly shows that even if something were written a particular way and he heard it played incorrectly on a recording, he would always remember what he heard and not what he saw. When it is a purely visual experience however, he considers what he sees as primary and considers it almost as a picture that was taken and that he can see in his mind. "If I had to find words to put it into, I'd say that's probably very accurate...a musical snapshot...for a moment at a time. Almost like a musical cartoon because the frame rates change to the next..."

The way of memory however, has one word which really summarizes the interviewees' way of looking at it...repetition. Repetition is really the answer for each of the interviewees, no matter which strategy they felt mores comfortable utilizing. This is true from beginners to the most advance. BM describes the process well by saying, "Actually, part of the method is to work the piece from beginning to end. Like I said, I'll learn a piece measure by measure, phrase by phrase, until I get to the end of the piece. And then I'll start over and do it again. So...each time I do it, it gets better and better. And of course...like I said before...it never gets perfect. But the actual raw work of the initial memorization is a process that's done very quickly for me...in a matter of hours or days." CP agrees, "Yeah, a lot of repetition. Usually with me, if I have to memorize a tune and I have the music, I'll play through it with the music a lot, and then I'll try to do small sections of it by memory...until it's pretty much all memorized."

4.7 The Tomatis Method

From the beginning of my studies and preliminary readings, the name of Alfred Tomatis has appeared often. His name and work have been mentioned frequently, and his understanding of audiation and its relationship to education have been accepted by many, as is evidenced by the over 250 Tomatis Centres worldwide with thousands of clients who have varying motor, memory, language and developmental disabilities (Sollier, 2003), (Sacarin, 2003). There are also numerous web sites which provide testimony, albeit much of which is subjective in nature, regarding this unique vehicle of rehabilitation (DeJean, 1998), (Davis, 2000). In this writing I would like to suggest that the Tomatis Method may be found to be beneficial to some clients who have a deficiency in specific areas related to audiation.

The ear is the primary source of learning and communication and so a deficiency in this area will manifest itself in music as well as language (Tomatis, 1996). Much of what Tomatis has written appears theoretically sound and practical, though there are some who criticize his work primarily because thus far there has not been sufficient amount of empirical studies completed (van Jaarsveld and du Plessis 1988), (Gilmor, 1989), (Kershner, (1990). In the van Jaarsveld and Gilmor articles, there are assertions that positive evidence is being documented, and specifically in the Gilmor article, Howard Stutt of McGill University is quoted as saying that, "the amount of experimental evidence is growing and is positive (Stutt, 1983)."

Kershner, however, creates a rather dim view of the Tomatis Listening Training Program in his writing of 1990 and states that, "results fail to support educational efficacy of the program but do support the efficacy of less exotic remedial procedures." There are some concerns regarding this study. First and foremost, the study involved a control group which received more types of intervention then the treatment group. In addition the intent of the study was to use the control group as a testing measure of possible placebo effects, but in reality because of its inconsistencies has caused a corruption of the initial aim of the study, and for all intents and purposes invalidated the study or at best coloured its findings. Also since the Tomatis program uses standard remedial strategies in addition to strategies specific to their technique, it does not appear as a valid claim that the Tomatis program fell short of

having at least some impact, since it began with normal appropriate educational remedial techniques and moved forward from there.

As researchers continue to learn and to probe the brain with its seemingly endless capabilities, it appears that the age-old adage is true, that 'the more we learn the less we know.' This is not a fault of medicine or education but is due to the complexity of the subject, the human brain and the evolution of our knowledge concerning it. Almost at the moment that a new insight is made, it seems that this new knowledge undoubtedly raises more questions then it answers. Neurology and its related disciplines have made great strides into the understanding of this complex organ and yet there is still so much to learn.

In the cases described in this study, we have made a comparative examination of how these different musicians utilize specific strategies in their musical memory skills. We have also looked at possible anatomical structures which may house these abilities and have, through interviews, spoken to normal as well as brain injured subjects with the hope that some further understanding may be gained by the words of the interviewees themselves. The results have been fascinating and most enlightening. There are accounts in these studies which point to exemplary rehabilitative techniques which have brought the likes of Pat Martino from utter despair back into the recording and performance circuit, as well as some of the other interviewees who are also doing remarkably well after their injuries (Resnicoff, September 1995), (Deffaa, 1997).

Not all are faring well however. CCT for instance, has been suffering continually on a personal and emotional level due to her TBI, although she is functioning and is currently at University. She still struggles with everyday routines and making rational, self-appreciating decisions, however, and is closely monitored by parents and counselors. SC is currently living in a group home as the team of social workers, counselors, and medical professionals have determined that she does not yet possess the skills needed to live on her own. She is, however, involved in many musical and social projects outside of the home, and her prognosis for a less structured living situation appears possible for the future.

Due to my initial interest in the Tomatis Method and readings, I have been in contact with professionals around the world who use the Tomatis Method in their work. Billie Thompson has translated a few of Dr Tomatis' works and has a thriving practice in Phoenix

and Los Angeles, where she utilizes the concepts of Tomatis and claims positive results in most clients. (Thompson and Andrews, 2000). I have visited Tomatis clinics in London and Paris where I have spoken with the practitioners who work with both children and adults using these concepts. Their claim is that the method has been successful for many clients but are also quick to point out that the Method is not appropriate for all, since it depends on the nature of the disability, the willingness of the client and the origin of the condition (Kerschner, 1990).

The Tomatis Method is based on over 50 years of clinical and research studies which are founded upon sensori-neural integration concepts. Dr Tomatis was an otolaryngologist who developed a system of dealing with impaired listening and communication by working with the ear and vestibular system (Thompson and Andrews, 1999). These systems impact communication, reading, language, and motor development among others. Tomatis found that since the ear is the initial and primary source of language, it holds the key to unlocking the mysteries of learning and communication. Young children learn language by listening and imitation. But what if the hearing apparatus is impaired? We know that the range of hearing is approximately 16 hz-20,000 Hz for the normal person. Is it reasonable to assume that with the many traumas an infant is exposed to; loud sounds, ear infections, birth trauma etc. that this range functions in its entirety and is experienced without fault? (Tomatis, 1991). Sounds reach the brain through the ear and auditory cortex, but what if there are errors while this data is being transmitted? We know that most infants are born with a dominant right hemisphere and that as language is acquired and developed there is a shift to the left hemisphere. When the shift does not occur in total or accurately there is a strong possibility that there will be language and communication difficulties. We also know that the optimum situation is for the dominant ear to be contralateral to the dominant brain hemisphere. What if this is not the case? Another situation may develop for the origin of language and learning disabilities. The Tomatis Method teaches that since the ear is the primary way a child learns to interact in his environment and gains control of language, it is the ear which most effectively educates the brain. This begins in the womb by the hearing and listening to the mother's voice, in addition to her internal sounds of respiration, the digestive system and other physiological sounds. Tomatis claims that upon birth the primary function of the ear is to energize the nervous

system by stimulating the neo-cortex of the brain. What happens when this ability is impaired or nonexistent? Could this also be one of the causes of learning and language disabilities? Disabilities can occur for a variety of reasons, some of which includes stressful or difficult pregnancies among other medical, physiological or psychological reasons. It has been proved that the hearing apparatus is the first organ to be fully developed at 4 1/2 months gestation, and so the outside world can have both a positive and negative effect on the foetus.

The work of Tomatis has been termed Audio-Psycho-Phonology, which assists in re-training people to listen and to use their ears properly by stimulating the muscles in the ear. Tomatis teaches that through auditory retraining of the muscles in the ear they can be strengthened just as the muscles in an arm or leg can be made stronger through exercise. As a practitioner, Tomatis has worked with many varied conditions all of which relate to the ear/brain network and impairment problems. The readings imply that this method may hold many important strategies for rehabilitation for the brain injured, most especially for musicians who have experienced TBI. With this in mind it should also be noted that the Tomatis Method does not claim to help everyone, for its aims are very specific. It cannot help someone for instance, who has permanent hearing loss or deafness. Dr Tomatis realized early in his career that there is quite a big difference between hearing and listening. Hearing is made of anatomical structures which are basically passive in nature. You only have to have the proper apparatus to hear. Listening however, is a conscious, active process, which entails being present to the source of the sound. To listen, one needs to be focused and the sound attended to. Brain injury can be the cause of a myriad of disabilities and affects almost every aspect of a person's life. The Tomatis method uses music (mostly Mozart, Gregorian Chant, or the mothers voice for very young children) to reacquaint and retrain the ear to its fullest potential.

In this thesis the focus has been placed on musicians who have experienced brain trauma and the data has explored how the trauma affected them in their music, especially in terms of musical memory. However, TBI is not experienced in a void, for as it affects musical abilities, it also impacts memory, motor skills and language among others. I will be speaking about the Tomatis Method primarily with amusia in mind, but since the effects of TBI has affected other areas of the interviewees lives, these areas of impairment will also be

mentioned. The following section will be an introduction to the work of Tomatis, his findings and the methods by which he implements these findings.

In 1953 Tomatis presented a paper to the French Academy of Sciences. In this paper Tomatis established a law which was agreed upon and accepted by the Academy. "The voice contains only the sounds which the ear hears." Though basic and elementary this statement is also quite profound. It states in essence that if there is something lacking or impaired in the hearing of an individual, there will be a correlating impairment in the sound of the voice. This is most readily apparent when one listens to a deaf person speak. They are unable to speak clearly because they cannot hear in a temporal way so as to monitor and control their voice and speech. Tomatis' father was a singer of opera who had many friends and acquaintances in this field. One of these was Maria Callas. She had complained to the senior Tomatis that a certain range of notes appeared to her to "be off", and for which she had no ready explanation. This problem was noticed when she had listened to recent recordings of her voice. Callas went to see Dr Tomatis who examined her and found that in a certain range of frequencies she was indeed impaired. This he explained was most likely due to the power of her voice and the proximity to the ear. Constant exposure to sounds above a certain decibel level (around 85 dB) can damage the hearing apparatus and make the muscles in the middle ear flaccid and lose their tone. Because of this, some of the incoming auditory stimuli was not able to be perceived by the inner ear and correctly processed by the auditory cortex. Using his method, Tomatis began to treat Callas and shortly thereafter she regained control of her hearing in these frequencies and the fullness of her voice returned. Tomatis found this to be the case with many singers who developed an auditory impairment due to the power of the human singing voice. In basic terms, what Tomatis did in essence was to strengthen the inner ear muscles. Using headphones with a bone conductive apparatus, Tomatis would play music, usually that of Mozart or Gregorian Chant and over a lengthy period of time filter out certain frequencies of the music until the ear was exposed to all frequencies. As certain frequencies are filtered out, the ear becomes sensitive to the sounds it does hear. It forces the muscles to attend to each unfiltered band of frequencies. The aim is to retrain the ear to hear all available frequencies in our normal range of hearing. As different frequency levels are filtered out, he is able to re-train the ears to hear by "flexing the muscles." Tomatis decided to test his theory.

Through experimentation, Tomatis had blocked certain frequencies from singers, and allowed them only a certain range to be heard. While singing with those frequencies blocked, the singers were unable to access the blocked frequencies and the voice deteriorated. This led to Tomatis' second theorem: If hearing is modified, the voice will change. Tomatis noticed that when his patients were able to hear high frequencies more accurately after treatment, they also became more energetic. It appears anatomically that there are many more receptor cells used in transmitting auditory information to the brain then with other organs. In fact the ear produces 85% of the energy which is derived from all the sensory organs. Thus, Tomatis found that high frequencies energize whereas lower frequencies deplete energy. The Tomatis Method also deals with the vestibular system which controls our perception of the three dimensions and keeps us abreast of where our body is in space also controlling muscle tone and balance. I mention this because Tomatis noticed that many people who have learning disabilities also have poor posture. He further noticed that after treatment in many cases posture improved. Children who continually slouched sat more erect and appeared more attentive according to Tomatis.

When one listens to a radio or television announcer, one is often struck by the resonance of the voice. Professional announcers almost always possess a voice that is rich in harmonics and who are precise in speech and enunciation. This is primarily due to an ear-dominance which is contralateral to their brain dominance. Tomatis found that since language is processed (in most people) in the left hemisphere which is connected to the right ear, that this is the more reliable connection. The left ear on the other hand is connected to the right hemisphere where there is no processing of language. Therefore, to make the connection, the corpus callosum is utilized to direct the data from the left hemisphere to the right hemisphere so that the language center can receive and interpret the information. This is a much slower connection and can introduce some delay. In the process and delay, the interpretation of language may be impaired. Upon the examination of the physiology of this there are five stages for the circuit running from the right ear to the left brain, and six stages from the left ear to the left brain. This can cause a delay of approximately 0.04 to 0.15 of a second depending upon the individual. A delay between 0.1 and 0.2 seconds has been found to produce a stutter (Tomatis, 1991).

If you watch people carefully you might see that they also favor speaking out of a particular side of their mouth. Usually it is found that it is contralateral to their dominant ear. For as a person will prefer right hand to left when writing, right foot to left when kicking a ball, there is also a preference for which ear a person may choose to attend to sound. People who possess a rasping, or dull sounding voice and who in many instances have some learning or language disabilities, demonstrate that there is poor sound analysis and usually poor lateralization.

Tomatis demonstrated that the first organ to be fully developed is that of hearing which is fully functional in utero at four and a half months. There have been numerous times in my work with children where I have noticed a child with a dull- flat voice lacking in harmonics. Out of curiosity I checked their personal files. More often then not some indication was found to be present that there was some medical/organic ear related condition. Most frequently it was found that the child had ear infections or some other related problem. There is an organic connection between the ear and the larynx which is manifested in the interdependency between speaking and language.

Tomatis found that early gross and fine motor development are milestones which some children have difficulty developing. The input which the vestibular system controls is also important in the motor development in a child. Adults who have experienced brain trauma appear to go through similar developmental stages that a child may experience. It is this early sensory development which the Tomatis Method addresses. One subject, SC, tells us, "And for the first two years I was going to a rehab that was in Manhasset, which is the town where my parents live, so I could live there ... so my quality of life was much better and much more enriched because I had the piano at my parents' house ... and later they paid for me to be able to go to a gym. So I was getting a lot of ... I had read somewhere that once someone becomes head-injured, they really need to go through their whole developmental process and try to experience things ... you know, in terms of ... crawl around ... see what it's like being a kid again. And do all those things. And swim. And do as many sensory-type things. And so physical exercise was certainly that. And it was also difficult just ... It was a fairly big gym, and it was a big cognitive exercise just remembering what the rules were ... where everything was. And I

would get lost. Now when I've gone there it's not ... I understand the layout of it. But originally it was just one incredible maze where I was just like ... I had no idea. And my sense of direction was totally off. And I would often get lost if I was going someplace new on the road, or whatever."

Many people suffering from TBI have vestibular difficulties. The vestibular system acts as a monitor which gives the person a sense of how his body is interacting with his environment. Each muscle of the body gives and takes information from the vestibular system which results in either good or poor posture. For LH there was a balance problem which resulted in a fear of falling especially upon riding a bicycle which LH very much enjoyed doing prior to his trauma. "I had a pretty bad balance problem and ... which of course created a fear in me about falling because I certainly didn't want to fall again. So it held me back until very recently from riding my bike. When the accident occurred, I had been on a real serious health and getting-in-shape regimen for about ... probably close to three years I had been riding a bicycle every day for about 7-8 miles. I was in tremendous physical condition, probably the best of my life. And my wife, being in the health field has always been a tremendous nutritionist and health food knowledgeable, and that always transferred throughout the family, so ... my diet was incredibly good at the time. I was in just tremendous condition. And they told me that was a wonderful thing that probably helped me recover as well as I did from the injury. But I had a very difficult time getting back on the bike, even though it had nothing to do with the accident. So after a while, I got the idea of getting a helmet. You know, they have the full, complete cranium cover like for racing ... you know, drivers wear ... so my wife bought me one of them. And I still really couldn't get back into it the way I used to because I was really into riding off road because I don't like to exercise. I've always thought it was ... running or riding a bike on the road is ... besides the possible danger of getting in an accident of some type ... is running behind cars that are emitting their exhaust all the time. It doesn't seem like a good way to exercise. So I was riding the bike in the Rocky Point Preserve a lot, and we have the five acres beside the house here, so I was gonna ride it here. And I still wasn't able to really get rid of the fear of falling and re-injuring myself because of the balance problem. Within the past six months or so, I've made great strides in

regaining a lot of areas in my health. I feel a lot more confident about my balance. I've been working on my balance as far as standing on one foot and practicing my balance, even if I have the bed or the bureau there ... to know that I can grab it if need be without falling. I'm doing much better." The problems experienced by SC were fairly similar to what LH experienced though to a lesser degree. For LH there is probably a psychological element due to the fact that his TBI occurred by falling.

Each person suffering from TBI experiences, to varying degrees, develop some form of depression. This is a natural occurrence stemming from the shock and resultant trauma which manifests itself in mood and appetite disorders, personality and socio-psychological difficulties, and a lack of energy. It very often affects sleep as well. In the classic sense of psychiatry and psychology, depression is explored from a pathological view which looks to the symptom and attempts to find the origin. In the interviews, all the musicians who experienced TBI spoke of the inability to concentrate, irritability, and appetite and sleep disturbances. The severe changes which need to take place, under the circumstances, surround a TBI victim. They will often feel isolated and alienated from their former life. Many feel a lack of meaning or find it difficult to find significance in their lives.

I am reminded of the work of Viktor Frankl who developed a psychiatric model called "Logotherapy" which espouses the belief that many people have an existential problem, in that their psychological difficulties stem from the meaning of or lack of meaning of their lives as they see it. Frankl developed his system while held in various concentration camps during World War II, as he observed the differences in how fellow inmates handled their very unique and horrible situation. He noticed that some were able to cope somewhat and others were thrown into despair for which if they remained there, they ultimately gave in to death. Frankl examined the why of despair as well as the why of acceptance (Frankl, 1997).

The Tomatis Method is used to combat depressive tendencies by awakening the inner ability to existential consciousness and creating the drive to actualize their innate potentials. Once the ear is taught to listen more fully the mind clears and becomes more energized and will be an asset and aid to traditional psychotherapeutic

techniques. At the Center for InnerChange in Denver, Dr. Ronald Minson is a psychiatrist who has been involved in using the Tomatis Method in his practice (Minson,2003). He finds that the Method is very beneficial as an adjunct to psychoanalysis. There have also been a few studies examining the positive relationship between the Tomatis Method and psychoanalysis in children. i.e. Peche (1975), Du Plessis (1982).

AB recalls, after her injury, that the frustration of not being able to remember caused much stress and depression. "Well, after the accident I couldn't remember anything. And one of the things the doctors would make me do is ... and I'm telling you this because I was told ... that they would give me food, for instance, and let me eat a few bites, and turn me around and say, which food were you eating? I didn't even remember that I was eating. They would be talking about something, and stop talking and say what were we talking about? No idea. When I slowly, slowly started playing again ... It took me 13 years ... When I eventually played something, the worst part was that I would stop anywhere playing and couldn't even remember if I was playing at all. Was I playing? What was I playing? Have I started the piece? Have I finished the piece? Was I playing at all? No recollection whatsoever. Sometimes I would be playing with the music, and if for some reason I would make a stop, I couldn't remember if I was playing ... It was very, very bad ... absolutely nothing."

CCT also remembers a painful period after her injury. "Yeah, mostly social, because I was rejected by everybody. I lost ... I had been class president ... fourth grade class president, fifth grade school president, sixth grade student council, seventh grade ... and I came back to school in December of that year ... Everybody was so happy to see me back, and I had like a portfolio full of cards and letters from everybody ... Oh, Clare, we miss you, we love you, we want you back, hope you feel better. And when I got back my behavior was so off and disinhibited, that everybody just left me, and I was left with one friend who was a social outcast herself ... who was valedictorian of our school and is now at Columbia ... but I don't know ..."

Pat Martino went through a severe depression, but in his inimitable style used the depression and his talent to explore creativity as a means of rehabilitation. "Because you must understand that the recovery itself was a period of boredom to the maximum. Prior to it becoming active on a creative basis, it was depression to extremes. And it was a

very compassionate way of that fading away ... which I'm very surprised at. How it took place was out of my control. And I do think that willpower has a great deal to do with interest ... in terms of creative output. And the more interest there is when it amplifies, the more productivity takes place. And the more that takes place ... I think that's the greatest form of recovery there can be. I finally picked up the guitar and began doodling on it, just like I was doodling with the computer. Again, to alleviate as much boredom as possible. And I would do that until I was bored, and then I would do something else. Always to put an end to the boredom. And that's what taught me the guitar. I think in terms of the similarities ... to stylish similarities ... I think a great deal of that is subliminal and was reactivated, and still is to some degree reactivated from time to time. And a lot more has reemerged than ever before. But re-attaining the abilities didn't come from initially what I used to do when I was younger, which was copy records. At that time it was Wes Montgomery, Johnny Smith, and others. A lot of, you know, the older, the way I used to play, came from subliminal reemergence."

As an educator, I recognize that the concepts of being able to focus and to concentrate is paramount to the learning process. Not only does the auditory system need to be working properly, but the ability to focus on the task at hand also needs to be accomplished.

Many patients with TBI have a difficulty of expressing language. JJ had experienced aphasia due to his TBI and found it difficult to find particular words expressed in everyday conversation. He says, " Well, since I broke my neck, I have headaches all the time. My body is like sore ... my neck and shoulder areas are sore all the time. As far as mental changes, my recall of things is slower ... even like words ... like when I'm having a conversation with someone and I'm trying to say something, like a certain word that would be normal for me ... it just would not come to me. You know, it would come back, but it had to wait a while. The same thing with people's names or any kind of memory. It just slowed down." The above examples are situations in which the Tomatis Method may be of assistance. For many, the Method assists first in the healing of the listening process. Once this improves, other areas are affected.

A case study which has been written about fairly extensively is that of the French

actor Gerard Depardieu. When Gerard was a young teenager he was diagnosed as a severe dyslexic and stuttered badly. He had become antisocial and had depressive tendencies. Tomatis took him under his wing and began treatment. Within a year improvements were many. His dyslexia began to disappear. Tomatis explained that Gerard was one of many children who are not able to hear the difference in the initial consonant sounds as in b and p, or s and z. This caused him much confusion and angst, because by the time he was able to ascertain by context what the person was saying, they were already one or two sentences ahead of him. This cause him to shut down, not communicate and have no desire to read, although in many ways he appeared to be most intelligent. Once he was retrained to listen correctly his dyslexic tendencies waned. Eventually his stuttering ceased, he appeared to be more socially stable. Gerard suddenly enjoyed reading and decided to become an actor. He noted that prior to treatment with the Tomatis Method, acting would have been the least probable occupation for a dyslexic and stutterer (Chutkow, 1994).

In summary, the Tomatis Method appears to have the potential for success in treating patients with TBI, especially where the trauma leads to amusia or related auditory disorders. There needs however, to be continued clinical research regarding this Method. Some evidence has been presented of a positive nature and although the principles of Tomatis are imminently sound, there still needs to be empirical studies performed, so that the Method may be accepted by more of the medical community.

5 Narratives

5.1 Preface to the Narratives

A qualitative case study requires that the interviewer be able to "step aside" from his own perspectives and worldview, to focus on the interviewee's perspectives and worldviews. This is done so as to avoid possible biases in interpreting the data and misrepresenting the world view of the interviewee. As a musician/educator veteran I found this task most difficult. This was due to the excitement of the dialogue in the pilot study, and in the incredible conversations I had with the subjects. When an interviewee spoke in an animated fashion regarding an experience, or some other interesting topic of conversation, I found that I preferred to allow them the freedom to continue with whatever thought was intriguing to them. I then asked follow up and pointed questions about what their topic was which in turn created a continuing in-depth commentary about their experience. Although this caused the dialogues to stray from the established interview questions, rich data was yielded as a result. My reason for explaining this in a preface before the actual narratives and analyses is to demonstrate that I am fully aware that some limited amount of bias did exist during these interviews. I did however allow this to occur with full knowledge, because of the valuable data I did elicit from the interviewees. In this case, stopping to do this would have prevented the sharing of pertinent information and constrained in an irretrievable way the flow of dialogue. In addition, time constraints due to the interviewee's health and schedules prevented any additional time for further delving. One of the most fundamental premises of qualitative research is to allow the person to define their own way of looking at things, thereby expressing their worldview. Under the circumstances presented to me I felt that this was more accurately achieved by my not interceding and allowing the subject to carry the topic where he/she felt it should lead. Also it should be explained that for each subject certain documents were requested; medical reports, questionnaire, reference names, etc. These requests were denied in certain circumstances for personal reasons. For instance, though JJ was able to explain his trauma in terms of location and type, he denied me access to his neurologist. In addition since

he had recently gone through a traumatic personal and emotional experience, he also denied my contacting friends and relatives. Therefore, many items which may have been helpful cannot be a part of his portion of the overall document. I did however keep these subjects because of the valuable information gleaned from our interviews, and the overall difficulty of finding additional musicians who have experienced brain trauma. When these requests were denied by the subjects, it is noted in their narrative.

While a great percentage of the material gathered is based on the interview with each subject, some additional information is taken from the questionnaire filled out by the interviewee. Also it should be noted that for the two musicians mentioned above, each of them are well known and have numerous reviews written about them, as well as videos, and CD's which have provided some added insights. The following information then are observations of the subject and his/her personal reflection on their experiences and not a clinical neurological examination. The following interviews then, are designed to give a basic understanding of how 'normal' musicians utilize their respective musical memory. Through a semi-structured interview based on qualitative design, it will illuminate that aspect of research which in many ways has been ignored by the main stream clinical researchers. Following the 'normal' musician's self concepts there will be an analysis of the six musicians who have experienced brain trauma. An examination and comparison of the six 'normal' musicians with the six who were brain damaged will also be presented.

5 Narratives

5.1 (a) Pilot Study Narratives

Basic Information and Background

BM is a professional musician. He is a married Afro-American male. At the time of the interview he was three months shy of being 57 years of age. BM is right-handed and began playing the piano at the age of five. He is a composer and has written numerous pieces in various genres, and for different vocal and instrumental ensembles. BM resides in New York City, and has performed in many parts of the world primarily as a conductor or pit musician for musical theatre. He has performed on Broadway and continues to conduct or perform in musical theatre.

Interview Analysis

BM was initially asked about his strategies for the memorization of music. When he first began studying he would just play a piece over and over until it was memorized (line 12-13). Upon entering college he began to approach this more analytically and broke down the pieces to be played by memory into smaller sections, down to measure by measure depending on complexity (13-14). A traditional classical piece may be done in four-bar phrases (line 15), or a more modern piece by Schoenberg might be done measure by measure (line 16). BM approaches this methodically and will work measure by measure until a piece is memorized (line 16-18). The time frame for a sonata would be two or three days of work (line 18-19). BM claimed that once it was memorized it was there in memory, "pretty much permanently" (line 23).

The question was asked whether or not he memorized both hands or separately. BM explained that it would depend on how complex the piece was, but that for pieces found in the average repertoire he would memorize using both hands (line 28-29).

We spoke about motor memory, or using a kinesthetic approach to musical memory. BM uses a "combination of the physical memorization in the fingers and ears" (line 34). He does not readily relate to music in a visual way (line 35). BM realizes that this is limiting when conducting, because a person with good visual memory could visualize the score (line 41-43).

BM does not hear the music before it is played but hears it simultaneously (line 48). He can hear wrong notes which can be detected even in complex modern pieces (line 49-51). BM can also hear a wrong note in a tone cluster (a series of notes close together, which to most ears would sound like a dissonance), or if the tone cluster is missing a tone (line 52-53). BM agrees to being more of an auditory person rather than a visual one (line 61), but also thinks that motor memory plays an important part in his ability (line 71-74). Motor memory for BM is based on repetition and patience. BM uses the image of shooting baskets, or hitting a baseball (line 81-84) in that it is the constant repetition which sharpens the eye.

A discussion arose regarding the memorization of lyrics. BM has been a stage performer in musical theater (line 102) in addition to his role as conductor or pit musician (line 87-88). He found it very difficult to memorize lyrics to songs or words of dialogue (line 90-92). BM knows many other conductors who memorize all the lyrics to shows, and sing the lyrics while they are conducting (line 112-113) though he is unable to do this (line 113). He can however remember song lyrics that were written up to the time he was about twenty years of age (line 115-116, 121-122), but not afterwards (line 116-117). BM feels more at ease and confident in reading music as compared to lyrics (line 124-125). BM has worked in foreign languages and though not fluent he has some grasp of French, Italian, and German. This began in college and continued as he toured Europe (line 133-138).

BM responded to a question regarding his success at the memorization process. His sense is that he is never totally successful and likens his lack of success to Rubenstein who commented that he himself had never performed perfectly (line 152-157). When asked what types of mistakes he was referring to he mentioned, "wrong notes, memory lapses, getting lost" (line 162-163). BM does not feel that the work of memorization is really ever finished, that it is an ongoing process (line 166-168). To his mind music is an art which is a pursuit of perfection, in that "you never arrive" (line 178-179). BM feels that the journey is more important than the destination (line 181).

We began discussing what happens to the memory process should a distraction occur. BM uses his memorization method and is able to focus on the task (line 199-201). His method dictates that he work the piece from beginning to end, so he is not likely to begin from a different section should he be distracted (line 205). He attacks the piece measure by measure,

phrase by phrase until its completion, then he repeats the process (line 206-207). BM admits that though the process goes very quickly, he says that "I'm not the kind of musician that once having memorized a piece, it's there permanently" (line 210-211). This statement contradicts a prior statement (line 23) where he claims that he can memorize a sonata "and have it there for....pretty much permanently." BM needs to practice a piece because it will fade in time (line 212). Each time he re-memorizes a piece however, it comes back to his memory more quickly (line 212-213).

BM differentiates between memorizing a piece for its own sake and memorizing it with the intent of performing it (line 234-236). His standards for performance are very high because he is aware of the stresses that can occur during a performance (line 243-244). He relies on motor memory due to the stresses that can occur in a performance. If the piece is really a part of his memory, he knows that he can rely on his motor memory (line 248-251).

The question was asked whether or not he uses harmonic analyses when he is memorizing a piece of music. He states that he does in fact think harmonically, that he hears chords and melodies (line 273). BM discusses the phenomenon of perfect pitch. He believes that on one level he has it, that he can automatically recognize pitches, "but it's not perfect" (line 275-279). BM is more sensitive to the sound of some instruments over others (line 283). On a piano which is his primary instrument, he can recognize almost any pitch (line 283-284). He however might be off in telling the pitch if someone were to sing the note to him (line 285-286). BM's belief is that he does not have perfect pitch because pianos are set at slightly different pitches (line 286-287). He contrasts this with a violinist who has always tuned his instrument to A440 and therefore may have more of a "perfect" perfect pitch.

BM has developed what he calls a very painful process with regards to his approach of memorization (line 327). It is a very mechanical process (line 331-332). BM doesn't analyze the music he plays, for he believes that he will absorb that in the memory process (line 334-336).

We discussed attention to detail when memorizing. When memorizing for instance, do we attend to the articulations, and dynamics. BM admits to not being very detailed during memorization except for notes (line 351). After the memory process is complete BM then takes into consideration all that the composer may have intended (line 355-357). He focuses

on the notes and feelings first (line 362), and then incorporates other elements like articulation and dynamics (line 362-363).

BM was asked how many pieces he could perform from memory. His answer initially was none (line 368). BM's reasoning is that he doesn't practice enough (line 372) and that there are different levels of success (line 372). He began to discuss his philosophy of the pursuit of perfection and gave the example of when he was on tour and came upon a university which had a basement full of grand pianos (line 381-383). BM played on these pianos for about 3 1/2 hours playing classical concert literature without repeating himself (line 384-386). He admits that these pieces were not up to public performance standards but were memorized enough for self enjoyment (line 386-388).

The question was raised about memorizing a style other than classical to which he stated that at times he memorized shows that he has conducted (line 407-410). He gave an example that the show "Ain't Misbehavin'" is a theatre piece that he has been called on to do quite often in his career, and commented that he "memorized that early on" (line 416). BM was then asked if it would shake his confidence if someone changed a portion of the show after he had it memorized. He did not think that that would be a problem (line 428-430). BM feels that because he can improvise and play jazz, adding some music would not cause him to be concerned (line 434).

BM has the ability to transpose on sight when accompanying singers (line 436-439). He notes that this is a skill that must be used or it can diminish in quality (line 452). A skill like sight reading improves when you have to utilize that area of expertise (line 453). He feels that the more you utilize a particular musical skill it will improve, and likens it to a muscle which can grow stronger or atrophy, depending on your use of it (line 457-458). When asked about the process of memorizing a transposed jazz piece BM claimed that the process would be different then when memorizing a standard Mozart sonata (line 493-496). BM does not consider himself a great jazz player (line 501-502) and admitted that in an improvisational setting he would use pre-thought out melodies instead of doing this "on the spot" (line 502-504.

BM is a composer and enjoys everything in the compositional process except the actual composing (line 522-530). His style of composition is early 20th century (line 534).

BM's style of composition though is changing as he ages, in that during his college years he wrote atonally, and now he composes more tonally (line 538-540).

When asked if he finds the task of memorizing easy, he responded affirmatively (line 546-549). His only flaw in terms of memorization is the lyric of a piece (line 563-564). He related an incident that occurred recently where he was on stage accompanying a singer who had forgotten a lyric. BM was unable to assist because he himself could not remember the words (line 568-570).

BM has stopped giving recitals (line 599). He used to give public recitals at the rate of approximately one a year (line 599-600). When conducting a show while playing the piano, BM plays with his left hand and conducts with his right (line 607-610). He does not always feel comfortable conducting by memory because someone in the ensemble or orchestra may be lost and may need a measure number (line 622-623). Since meter changes, sometimes often in musical theatre BM marks beginning measures with slash marks indicating how many beats per measure the piece is felt in (line 644-647.

We spoke about confidence which BM feels is all in the preparation (line 651-652). He related an incident in which the theatre for which he worked was not prepared and he needed to use his normal preparation time assisting the producer. BM felt therefore that he was unprepared for his role as musical director (line 651-657).

BM memorizes standard classical music primarily (line 672). He finds that Bach is the most difficult because of the contrapuntal nature of his music (line 672-678). BM can fake his way through other composers like Mozart, Beethoven, even Schoenberg, and Prokofiev, but not Bach (line 680-682).

The pieces that he memorizes are professional concert literature (line 703-705). BM loves classical music and because of its inherent difficulty he feels that it makes his professional playing in the theater much easier (line 709-711).

Basic Information and Background

CC is a right-handed male Caucasian who was 31 years of age at the time of the interview. His primary instruments are keyboards, but he also is proficient on bass guitar. He began his piano studies at age four. CC has credits on a post-Masters degree level, and is teaching vocal music in a New York public school. He is a Liturgical Minister in a church where he plays and conducts the choir. CC is a composer who primarily writes for the church. He has absolute pitch and a memory that can be described as very near photographic.

Interview Analysis

In his response to the first question where he was asked about his process for memorizing music, CC responded that he would play it again and again, until it stays within his auditory memory (line 10-12). He also admitted that the memorization process is not always purposefully done for he finds that many things are remembered in an automatic fashion(line 12). CC possesses absolute pitch (line 14-17). He feels that this innate skill enhances his ability to memorize (line 19-21) since CC can remember a piece that he has not played for years, and even without the music can play it from his motor memory (line 25-27). His auditory memory is very sophisticated, and this very easily translates to his motor memory. The basic tune resides in his brain, and his motor skills flesh out the details (line 28-32).

CC suggested that the primary way he hears is the chordal structure of a piece (line 36). He hears some musical elements vertically (harmonically) and others horizontally (linearly) (line 37-38). They are interwoven and inseparable (line 37-38). Once a piece is committed to memory, the music is not needed anymore. This ability can last for months or even years (line 39-42) though he may need to touch it up if the time away from the piece has been extensive (line 41) or if the piece is of a more difficult nature. CC hears the movement from one chord to another (line 46-47). He can also recognize types of chords (major, minor, etc.) and root names (line 48). His ability extends beyond the recognition of primary chords (line 52-53). The question was asked whether or not he could recognize a complex jazz chord. CC claims that though he would have to think about the actual name, but he could play it back immediately (line 58-59).

We then had a discussion concerning motor memory. CC senses that his hands intuitively know where to go, once the piece is in his memory (line 67-70). He feels that this is a brain function rather than a kinesthetic sense (line 76-79). CC mentioned that the kinesthetic feel for things is one of his weaker skills (line 86).

CC reiterated why he felt that having absolute pitch increased his chances of being successful at the memorization process. He memorizes primarily through the ear (line 93-94). CC's ear is well developed and has a sense of how the music should sound before it is played (line 94-96). When he looks at the music he may fill in some of the things that he did not pick up upon the first hearing (line 96-99).

When thinking about his musical memory, CC will notice the chordal structure first (line 101-104), though to him the chords and melody are inseparable (line 108). He used the example of Handel, because his ability to understand music comes from the idea of a single melody supported by a harmonic structure (line 111-114). This is unlike Bach, who sometimes will have complex counterpoint and polyphony involved in much of his compositions (line 112). CC does not separate the elements of music but hears it as if it were a whole picture. What registers for him is the forest and not the individual trees (line 122-124).

CC was asked how he perceives one chord going to the next. Does he hear it as a I chord moving to a IV chord, or does he hear a C-E-G moving to an F-A-C? CC hears this as the notes moving and not the analytical way (line 131-132). He does not concentrate at all upon the harmonies as a way of analyzation (line 137), but simply hears the harmonies that are (line 137). Through the act of repetition they become automatically committed to memory (line 138-139). He is aware however when playing, what the chordal structures are because of the harmonic direction it provides (line 145-147). At this point I commented that I thought his approach is "less analytical and more intuitive" (line 149). To this he agreed (line 151), and upon which he added that in college he did poorly in analysis because he was forced to put labels on things that were intuitive (line 151-152).

As we deepened our discussion and began to summarize, CC mentioned that the melody and harmonic structure he uses for memorization needed also to incorporate the element of rhythm (line 163-164). When hearing a harmonic structure CC will say "that was an eighth-note C# on top in an F# chord, with an A# in the bass (line 165-166). When the next

chord strikes and he will provide the same details and be able to provide a linear explanation of the connection between the two harmonic structures (line 167-169).

In his every day life apart from music CC admits to being a very detailed person (line 171). He is also a visual learner (line 171). During this interview CC was able to provide me with a detailed description of a house I previously had lived in, one in which CC had not been in for at least 2-3 years. He was able to describe it, down to the colors of the bedspread, where items were located, etc. (line 172-176). CC claims not to attempt this kind of remembering, it just occurs (line 176-182). He remembers directions to places where he had only been once (line 184). An map-like image can be constructed in his mind as to what it should look like, or with music, he might make a mental map of what should be happening next, target chords, and can perceive what it will look like and sound like (line 185-190). CC claims that his is not a photographic memory, but close to one (line 194-195).

CC conducts young people in his school/work situation and works with adults in a church/liturgical setting. He was asked what he sees in his mind as he conducts them or plays the keyboard for them. CC is listening to the piece in his head (line 207-208), so he is aware of entrances because he has just heard it in his mind (line 207-209). When CC conducts he could tell you where everything is and on what page (line 220-221). He says "it just belongs there" (line 222). If he chooses to think of it this way the measure on a particular page and the music become inseparable (line 223-224). These kind of memories do not last as long as musical memories however (line 227-228).

The question was asked as to whether CC considers his rhythmic memory to be equal to the harmonic and melodic memory. His response was affirmative, because it is all a part of the same experience (line 234-235).

CC does not feel that his auditory memory is different than others, but that once it is there he feels that he is experiencing it differently (line 247-249). While others might be hearing a specific interval, CC will hear the names of the notes (line 249-250). This does not mean to CC that he can give back this information any sooner, only that once it is there, it is there for good (line 251-252), especially if he chooses to commit it to memory (line 252-253). He was asked how he would process an interval played i.e. C up to an A, to which he stated that he would not necessarily think of it as a major 6^{th}, but would recognize it as the notes C to

A (line 255-258). In an ear training course as in college he would have to process backwards since he would hear the note names first rather than the interval (line 264-269), although for the simpler intervals, he can recognize both (line 267-268).

We discussed the difference in compositional styles between Bach and Handel. CC maintains that if the compositional texture is thicker he would find that to notate this would be more difficult (line 278). On his listening to a more polyphonic piece CC would still hear harmonically and melodically, though fully aware that there is more happening (line 279-282). There is too much to interpret unless he focuses on one melody at a time (line 282-283). This process is very difficult (line 282). If he has the score, he can use his visual memory and use his motor memory and feels that he is actually creating what is on the page. He is now training his mind to commit the polyphony to memory (line 283-286). CC finds it difficult to hear a jazz solo because it does not always remain constantly tonal (line 288-290). He knows that he has a very strong sense of tonality in his approach to music (line 292-294). CC cannot not hear or appreciate atonal music because it does not make harmonic sense to him (line 302-304).

CC, upon hearing a piece for the first time in the style of Handel would immediately identify the chords, bass line and melody (line 310-311). He would also be able to identify the harmonic structure and its progression from one chordal structure to the other (line 312-313). Even with a Bach chorale, CC would still hear the harmonic structure and its movement from chord to chord (line 313-315). When asked how many hearings it would take to hear a four-part Bach chorale before accurate notating could take place, CC responded, four or five (line 325-326). He would listen for the soprano and bass first (line 327), then being aware of the types of chords these could possible create, he would then fill in the middle voices (line 328-329). More time would be spent on the middle voices than the bass and soprano (line 330-331). CC would listen to each part, note by note after the first couple of hearings and that the chord he heard spelled correctly even if at this stage the alto and tenor lines were reversed (line 336-341). He commented that he could play it back most likely after the second hearing, but admitted that it may not be 100 percent accurate (line 343-345). The harmonies, soprano and bass would be correct however (line 345-346).

CC knows that he has been successful at memory when the music is no longer needed, and that he can play it as he sees it in his mind, being aware of where he is in the music and

what page he happens to be on (line 355-358). This would stay with him for a long time (line 359).

CC was unsure how long it would take to memorize a 32 measure four-part Bach chorale (line 366-367), though the process would be the same for any kind of memorized music (line 365-366). He was asked about whether or not a piece by Mozart or a sonatina by Beethoven would be the same in process, to which he replied affirmatively (line 373-377).

When working as a music minister in his church, CC only needs to see the words, and if he knows the melody he can harmonize the piece and play it in any key (line 382-384). Depending on the situation he might transpose the piece if needed (line 384-385). CC can transpose the piece in any key if has committed it to memory first (line 386-388). He was questioned on whether or not he could transpose a short piece by Mozart from the key of C to the key of D. CC agreed that there may be a few mistakes but he feels that this might occur because his muscle memory would be used to playing it in the old key (line 399-401). He feels that he would not be actually transposing it in the new key, but merely hearing it in his head in the new key (line 401-402). When CC transposes in this manner, the character of the piece takes on a new sound for him (line 414-415). Of course he would recognize the piece, but the key change from D flat to C, creates a change in the overall character and quality of sound (line 415-418). He was asked to define what he means by the change in character and quality. CC responded that each key only sounds like itself. The key of C only sounds like C, D flat only sounds like D flat (line 422). CC tends to write in flat keys because to him they sound more mellow and deeper emotionally (line 423- 424). Diatonic notes even have a brighter sound to him (line 424-425).

Sometimes CC sees color when hearing music (line 427-429), especially chords (line 433). To him, the key of G is always green, E minor is always brown (line 437) CC labels the E minor as a somber, brown yuck type (line 478). He admitted that not all chords have color (line 441), because these were "primary things I was doing when I was younger and when I was first experiencing music" (line 441-442). CC acknowledged that C would be red and the others as mentioned above (line 451). These color associations occurred when he was a child and he doesn't have them anymore (line 453-454). CC can see the colors in his mind when he makes himself aware of it (line 458). He reiterated that this occurred when he was small and

these experiences came a little easier then, unlike now when he is doing other things simultaneously (line 459-461). CC feels that the color may have been a part of an association he had as a child. Apparently the organ he used in church had green stickers on each pedal. He may have just begun to associate the pedal with the key of the piece (line 467-470).

We discussed the elements that are on the conscious level when memorizing. CC responded that it was mostly chords, bass line, melody and rhythm (line 510). He finds it difficult to separate them (line 510). The last thing he notices are the lyrics (line 521). CC rarely notices what the songs are about (line 521-522). He mentions that he could hear songs for years and never notice the words of the songs (line 522-523). To him this is the least important aspect of a song (line 525, 526-527).

CC when asked about articulation explained that it is inseparable from the other elements (line 531). From one piece to the next, the note is not always just an F but maybe a staccato F (line 531-532), because that is the way it sounded (line 532). CC gave the example that if he heard a tape of someone playing a piece of music and they played a staccato in the wrong spot, he would continue to play it incorrectly because of his strong auditory memory (line 534-537). He said it is like taking a musical snapshot, moment by moment (line 542-543).

The question of being interrupted while memorizing came up. To CC it would just be a matter of "putting on the recording again" (line 550). His process of memorization happens in stages (line 551) and CC agrees that he memorizes aurally rather than visually (line 566-568). He also has the ability to recreate a moment in time in a visual sense (line 570-573).

CC doesn't feel that he memorizes any quicker than anyone else (line 580-581), but only that when it is committed to memory it is there for a long time afterwards (line 581-582). He judges how well he is doing with regards to memory when he notices that he uses the music less and less during a practice session (line 583-585). CC is creative enough to improvise his own very similar arrangement (line 588-589), but most times he is interested in the exact piece (line 589-590). To him variations are the most difficult to memorize because of the subtle differences from one section to the next (line 594-595).

Being unsure of what he exactly meant by variations we explored this concept further. CC clarified the idea by explaining that in a piece written by him might have a different

accompaniment in different verses (line 601-603). To remember when this occurs takes a conscious thought (line 604-605). In a second example he gave he described another original piece where he might have re-harmonized a particular section (line 605-606), he has to concentrate on where this change takes place (line 607-609).

CC was asked whether octave placement was a consideration for memorization, for instance a lullaby in the high treble range rather than a piece utilizing most octaves on a keyboard. His response was, no because "notes are notes" (line 615-618). For CC they are visual pictures (line 618).

The question was asked whether or not CC hears actual frequencies (line 620). He responded no, but added that he could hear if a note was A=444 (line 628) as compared to A=440. This note would sound a little sharper than the normal tuning of A=440 (line 629). CC agreed that it would be close to impossible for him to play an instrument which is out of tune (line 634), because he would be making mistakes reaching for a note expecting a particular sound and getting another (line 639-640).

CC does not need the transpose function on an electronic keyboard because his own transpositional skills are so sophisticated (line 652). If he did use the transpose function, he feels that he would make many mistakes because notes that he instinctively knows should sound a certain way, would sound wrong to him (line 658-661).

We discussed how many pieces CC could perform from memory. His response was "probably hundreds" (line 666). Immediately after a phone call that occurred during the interview, CC stopped by his piano and played an old jazz piece of mine. I asked CC when was the last time he had played that. He agreed that it was probably more than a year or two before the interview (line 678-679). CC had improvised much of what I heard, but the harmonies and melody were intact. He was asked how it occurred in his mind. CC said that "it's just there. It's present in my brain." (line 685). His musical memory was likened to reciting a child's poem like "Little Miss Muffet." His ability to rattle off musical pieces was like he was reciting a musical "Little Miss Muffet." He said that it is like turning on a switch (line 690). CC says to himself that he would like to hear Peter's song, and it would be there (line 690-691). He finds it hard to absorb things that are out of a traditional key (line 693-695). CC thinks that it stems from the fact that he cannot hear these non-diatonic melodies and

harmonies (line 698-699). When trying to improvise a solo, he admits that he just cannot hear it (line 700).

CC was asked how long it would take him to memorize a 32 measure Bach chorale. He clarified what was meant for him by the word memorize by saying that "I would never need the music again" (line 715-716). His response was two-three hours over the course of a few days (line 717-718), and that it wouldn't happen all in one sitting (line 716-717). CC would play the piece each day until he really owned it (line 721). CC uses visual imagery a great deal, imagining his hands moving in his mind playing the piece (line 723). He sometimes dreams about playing the piano and hears music, thinking the notes and naming them, just as if he were awake (line 723-728).

If CC needed to perform the piece, he would definitely refresh himself over the course of time, as each day of practice it would become more a part of his memory (line 734-743). As a teacher CC has given concerts for the last three years, and has never used the music (line 747-748). He has prided himself in this fact and to do the best he can without the music and has had great success (line 748-751). Some examples of musical works that he has conducted/played are Broadway styled pieces and classical (line 755). On occasion he will conduct something like a Randall Thompson piece that he does not want to play live because the accompaniment is better than what he feels he would come up with (line 757-759).

When questioned about the element of confidence CC mentioned being nervous at the moment of performance (line 769), rather than a worry of forgetting or being unable to perform successfully (line 766-767). He feels that it is a big moment, that it is what people have waited for. This unnerves him (line 769-771).

The style of music for memorization does not matter to CC (line 773-775). Traditional styles would be no problem, though modern music might give him some trouble (line 777). He would find similar difficulties with jazz because of the solo lines (line 785). In modern music, CC would not hear chords, so to him it would make no sense (line 785-787). For CC it would make no sense musically, both harmonically and melodically (line 789-791). CC could handle the harmonies in a jazz piece that stays tonal but not the soloing (line 795-797). He was questioned on reproducing a solo line and was asked if he might hear it as modal. CC does not think of modal, only naming the notes that he hears (line 803-807).

Basic Information and Background

CP is a right-handed male Caucasian who was 43 at the time of the interview. He is a teacher in the New York public school system. His primary instrument is percussion though he also is proficient on the alto saxophone and the guitar. CP began his studies on percussion at the age of 11. He is a published composer writing primarily for school organizations for their jazz ensembles and concert bands.

CP went to Queens College and received a Bachelors Degree (line 10). He began a professional career playing on cruise ships and went on the road for a two-year period (line 11), all the while composing music (line 11-12) which he considers his main musical interest (line 12). CP began teaching in the public schools for a five year period (line 12-13). He then left this position to study composition in the Los Angeles area (line 13). CP went to Brazil where he taught for a three year period (line 13-14). He then went to Alabama to study for his Masters Degree for a two-year period (line 14). CP went to Singapore for a four-year period (line 14-15) upon which he came back to the original area where he began teaching (see line 12) (line 15). When he went on the road it was with a club band. He claims to have been disenchanted with school (line 24-25).

Interview Analysis

CP primarily uses repetition as a means of memorizing music (line 31). When he has the music in hand he will play through it often (line 32), and then take it in smaller sections until it is memorized (line 32-33). He reaffirmed that he was talking to me about tunes of a pop or jazz nature (line 36-38), and not a lengthy classical piece (line 33-34). The sections would probably be approximately sixteen measures, a phrase (line 47).

CP focuses on the melody primarily (line 52) then the bridge of the tune (line 55-57). As an instrumentalist he does not focus on the harmonic aspect of the piece (line 65-66). Harmony would be a second focus (line 66-67). CP questioned his ability to memorize because even songs that he has written, if someone questioned the key it was written in he claimed he would not be able to remember (line 68-69). He does not remember the harmonic chord changes (line 70-71). CP mentioned that he may not remember because he writes a great

deal (line 75-77). He reiterated that he was speaking about the saxophone at this point (line 80-82).

In terms of composing CP writes melodically first (line 101), then he would create the harmonic structure (line 101-102). When composing he does not use a keyboard (line 102-103). He feels that melodic writing is in its purest form when it is written away from a keyboard (line 103-104). CP gave the example of great folk tunes, in that they withstand the element of time because they possess 'perfect melodies' (line 104-105). After completing the melodic writing, he will utilize a keyboard when creating the harmonies (line 105-106). CP orchestrates and arranges at the same time. He does not use a 'lead sheet' but begins scoring immediately (line 106-108). Currently he composes concert band and jazz ensemble literature (line 112). When composing CP can hear basic harmonies without a keyboard (line 121). He finds that the melodies written without a keyboard are accurate unless it is more of an involved melody with many notes or chromatic in nature (line 128-132).

He was questioned on his jazz writing and the importance of articulation. CP responded that the element of articulation is always the last element (line 137). Melody, bass line, harmonic structure, then the articulations (line 138-139). He will hear where he would place the articulations upon writing the melody but would hold off until the other elements are completed (line 139-140).

CP has melodies from years ago residing in his memory, tunes that he has written (line 164-166). There are those however that he has totally forgotten (line 166-169). CP was asked how he remembers these pieces. What about them jars his memory. His response was the melodies (line 174).

CP has written pieces for all levels of public school ensembles. As I was waiting to meet CP at his school, he was rehearsing a 5th grade band. The piece they were rehearsing was a composition by CP. He was more aware of the range of the trumpets than the key (line 216-217). I questioned his remembering melodies, and asked what the next element might be, that would spark a memory. His response was harmony (line 230). When listening to a jazz piece and you hear the harmony, CP can tell which tune it is (line 230-232).

We discussed how long it would take CP to memorize a new jazz piece. He thinks a few weeks would be enough time should the piece be involved (line 248-250). CP would

remember it in his head (line 250), but to play it, a few weeks. To memorize it well enough to write it out, would take him about three weeks (line 266), unless money were involved (line 266-267). CP was not sure if he would be able to memorize the piece by listening to it and studying the lead sheet (line 271-272). He thought it might be quicker if he played it (line 274-276). CP mentioned that if he knew the piece well enough and knew the key, without seeing it, he might be able to do this slowly (line 276-278). He gave the example of a song that needed to be memorized for the faculty portion of a concert, and even though he was familiar with the song, he had not played it in a while. He needed to practice for about a week (line 287-288).

CP was asked about the kinesthetic feel of the instrument and its influence on memorization. He responded that he thought that was important for him (line 297-300). CP gave the example of when he would memorize material played by Charlie Parker, he could sense what Parker was doing (line 304-305). CP would understand because of the feel of certain passages (line 315-316), and that he could "feel his fingers in yours" (line 319-322). He could sense what someone is doing on the saxophone more easily than the piano (line 322-323). CP does not feel that he has as good a skill as others who can play whatever then hear (line 324-325).

CP was asked about distractions and the process of memorization. We discussed where he would begin again after the distraction. As an example had he already memorized the A section prior to the distraction, then coming back to finish, he would still possess the 'A' section in his memory to a great degree (line 346). CP begins in different spots when he memorizes (line 347). If he does not do it this way he cannot memorize the piece (line 349-350). If he always began at the beginning he would have to break it up into chunks and then put it all together (line 354-355). The reason CP gives for this is that if he really knows the tune, he should be able to begin it anywhere in the piece (line 365-367). On a club date, it is important to know the material (line 367-368). CP realized that since he has memorized certain tunes, recently when he tried to remember them he was unable (line 381-384).

When composing CP writes in a linear style (line 390-393). He studied for a year at the Grove School in California which emphasized writing away from the keyboard (line 393-395). CP begins in a linear fashion and then harmonizes (line 398-399). He know uses computers to play back music he used to only hear when he was able to get musicians together (line 413-

416). The composition/arranging projects would be very time consuming before the advent of computers (line 425-428).

CP does not perform from memory any longer though he would in the past play every weekend (line 449-456). At one point CP joined a road band and needed to memorize arrangements and steps for which he was successful (line 461-464).

Different styles of music would be memorized with the same process (line 481), unless it was atonal (line 482), or to memorize arrangements and steps (line 461-464).

Basic Information and Background

DB was a 43 year old professional musician at the time of the interview. He is male, right-handed and is Caucasian/Asian. His primary instrument is the guitar, though he is proficient on the piano, bass, and drums. He is a member of a local popular group and performs often. In this musical group he and his partner utilize previously sequenced material, to which he will add live guitar or bass. DB is also a fine pop song stylist. Though self-taught, DB has been playing the guitar since age 7. DB creates sequenced orchestrations of pop, rock, and jazz pieces which are sold to various producers. He also recently put together an intricately timed musical show to be played during a major fireworks display.

Interview Analysis

DB was asked to explain the processes that he uses to memorize music. His responded that his most common way is just to listen to it and play it (line 4). He possesses an excellent ear and should a piano or guitar be handy, he would work out the chords and try and play it by ear (line 4-5). He examines the music carefully and would look for any kind of defining characteristics which would assist in the memorization process (line 6-7). For a simple song, DB would simply memorize it (line 8), but if it is more complex he would take notes about the melody, chords, and lyrics (line 8-10). He would then put this aside for a while and come back to test his memory (line 10-11). He would reinforce parts that may have given him trouble until he felt like he could play it all the way through (line 11-13). DB is an aural learner (line 16-19). Should the song be simple he can just commit it to memory in one sitting (line 25-26). A piece which is more complex he would listen closely to specific instruments (line 34-35). If he is completing a guitar arrangement he would listen carefully to the instruments and try and work out a guitar style which emulates what he is hearing (line 34-40. DB would also look for colorations in the background to try and incorporate (line 41-42).

DB finds it easier to memorize than read a score (line 47). He can read a fake book with the chords, melody, and lyrics (line 47-48) but DB does not read music on a professional level (line 50-51), instead he relies on his sophisticated listening abilities.

When DB performs as a singer, he uses his memory of lyrics to create in his mind a scene of what the song is about (line 57-58). If the song tells a story he might picture the story

unfolding in his mind (line 58-59). DB feels that this assists him in remember the lyrics (line 62). In terms of the music, he may visualize a band playing (line 62-63). He gave the example that if were performing and he wanted to play a short guitar riff, he may visualize a pianist stepping in at that moment. DB would then allow that short visual scene to trigger his memory (line 64-67).

He was asked about measuring his success of memorization and replied that if he gets paid at the end of the night, he did ok (line 73-74). In terms of his self-measuring, DB responded that if it felt comfortable, and if he did not have to work hard at the remembering process he feels that he was successful (line 78-80). He does not want to be too mechanical in his delivery, because he feels that he may be concentrating too hard and not entertaining (line 80-84). When performing he wants to connect with the people, and feels that if he is busy trying to remember he has failed as an entertainer (line 85-88).

In terms of distractions DB finds the phone particularly annoying, as well as his children being loud (line 93). He commented that he would find the human voice less of a distraction than music (line 106-107). DB has to mentally push it in the background and not even give it a chance to distract him (line 111-112). Even with a news report, if the story catches his interest he would be distracted (line 113-114). He feels that he would be most distracted with music above all else. DB would still be able to memorize but not very successfully (line 116-118). If he is distracted and then tries to get back on track he has to concentrate and regroup (line 123). We discussed his getting distracted and whether or not he would have to begin from the beginning, or could he start again from where he left off. DB claims that he would be able to go to the section and not have to start at the beginning (line 131-132). He would find it difficult to go to the middle of a section, but he would not have to begin again (line 132-136). DB would then test his memory to see if in fact he did have the prior section really memorized after being distracted (line 140-143).

DB was asked about the elements of music and the order in which they might be memorized. He feels that the melody would be the most important (line 160). Depending on the song, with some pieces the chords are just as important (line 161-162). "Sometimes one isn't necessarily more important than the other." (line 162-163). When scoring something after the bass lines, and keyboard parts, he would work on the rhythm (line 164-166). DB would

begin the tempo changes and dynamic elements after the basic melody, harmony and rhythm was completed (line 168-169).

DB has in his memory over 200 songs which is less than he had a few years ago (line 181, 177). He explained his perspective on what popular meant. To his mind anything which the people he is performing for would recognize (line 199-200). To this end it could include a popular show tune, R&B or folk song (line 194-198). DB uses the same memorization process for all the styles of music except for blues and jazz instrumentals (line 206-209). By way of explanation DB maintains that in the blues, the structure is the important thing (line 212-214), as in the progression of chords (line 214-215). The rest of the performance in improvisatory in nature, which adds a little bit of excitement and edge (line 219-220).

DB was asked how long it would take to learn a half-dozen songs for a special occasion, where he was not familiar with any of the tunes. DB responded that in his particular situation, to be ready for a performance situation, he would have to sequence all the tracks, teach his partner the melody/harmony, and the arrangement. For all this process, DB would need a month (line 228-233). For a less complicated performance of just voice and guitar, if the pieces were relatively simple it would take him about two weeks (line 241-242).

Though DB loves the jazz idiom, he feels that he is not proficient in that area (line 271-274). He grew up listening to folk music primarily (line 278). DB listens to Pete Seeger, songs with a story line, simple melodies and harmonies (line 278-282). This follows through to rock and roll, which gives him a hard time because it was not a part of his early years (line 283-287).

DB would find jazz most difficult to memorize, but classical is also not easy for him (line 289-296). He was asked how many songs he plays on the job by memory. DB performs two-four times per week for four hours each time. In this time-frame he has memorized approximately two hours worth of music (line 313-316).

Rating his success at memorization, DB responded that for a single performance of a newly memorized song is very successful (line 323-324). For recalling that same song a month later, with no re-familiarization would yield about a 50% success rate (line 324-326). For DB the easier the song, the less memorization and more he can entertain (line 334-336). He gave the example of singing Sinatra songs which he only started doing when he was 30 (line 337-

340). Overall DB feels that he is successful at musical memorization (line 352-254). DB uses cheat sheets when performing which he uses if the need arises (line 366-368). When he did not use cheat sheets he still considered himself fairly successful (line 364-366).

DB considers confidence in the entertaining process, but not in the memorization process (line 372-373). In performance one needs to have a high level of confidence in all situations except recording, for which music is used (line 381-385). DB was asked what part of memorization would make him reticent in any way. He responded that the complexity of a piece would be a factor (line 394). If the piece was of a different style than the normal genre (line 395-397). When asked to give names of tunes he frequently performs from memory, he responded with "The Beatles" "I've Got You Under My Skin (line 407-410). Although he keeps cheat sheets handy during these performances, he does not use them (line 414, 422). The ones he consistently performs get burned in his memory because of the repetition (line 424-426). Pieces performed by DB are very easy in his estimation (line 428-430).

DB has been performing in this way for about three or four years (line 435). He enjoys a mixed crowd when performing (line 451-457). The main performance venues include private parties and restaurants (line 473-478).

Basic Information and Background

ED is a right-handed female who was about to turn 42 years of age at the time of the interview. She is a vocalist who began her training at age 14. ED also plays the piano. After finishing high school ED received her bachelor's degree in vocal performance (line 6-7). On a weekly basis for about six years ED studied with a voice teacher in New York City (line 11-12), and three years with a vocal coach also in New York City (line 12-13).

Interview Analysis

We began our interview with a discussion of her background as stated above and her recent professional engagements. As of late ED has been performing as a soloist in concert settings (line 17). She performed in a Bach Cantata with a local college (line 17), and performed in a concert version of "Cosi fan tutte" (line 18). ED put together an evening of concert material called "American Dreamers", (line 18-23), as well as an concert of operatic arias and music from Broadway (line 23-26). I had previously worked with ED in many musical theatre projects, but she had not performed in this genre for three or four years (line 28-30).

ED was asked about her musical memory and her strategies for the process of memorization. She states that her first step is to "tear the piece apart rhythmically" (line 37-38), examining the time signatures, clapping the rhythms. ED then will play the melody line on the piano, to assure herself that the melody and rhythm is correct (line 38-40). The words are examined next as to the way the syllables fit with the melodic structure (line 40-41). ED then works on the translation when the piece would be in a language other than English (line 41-42). She will examine each word with a dictionary even if it is in English to try and understand what the composer is trying to convey (line 42-45). For a longer piece, ED examines it in smaller sections as she did with the Bach cantata. Each section can be several pages in length (line 51-53). When the piece is long, she may spend a week on one part if time is available (line 53-56). When a song is short perhaps in an ABA form, ED would learn the melody first, then the bridge, learning it as it is written (line 55-57). She does examine the harmonic structure and will play the accompaniment to hear what is going on beneath her

vocal (line 62-64). ED prefers learning the piece on her own before listening to artists performing the same piece (line 69-72).

ED has recordings of her work which she listens to critically. She performed in a competition in which she was a finalist. Each step of the process was recorded. ED examined it afterwards as a way of increasing her performance quality (line 81-84). The examination included an analysis of pitch, tonality, emotion (line 88). She observed that listening to a recording is much different than watching a performance in that noticing the emotions in body and facial movement is non-existent in a recording (line 89-93).

If distracted ED always begins again from the beginning of the piece and does not begin where she left off as she prefers to be orderly (line 100-110). ED stated when asked about retention of music, that the Bach cantata she sang one year ago could be performed tomorrow (line 112-119). When ordering the elements of music as they relate to the memorization process ED learns the melody first, and then will incorporate the dynamics and other markings (line 132-135). She is a visual learner in that she will memorize what the notes look like on a page. Although she analyzes the meaning of a piece, she feels that a more important part is to visualize the page. ED can see all the pages including page numbers. This is a technique she learned in college (line 139-154). ED will listen to a recording of a piece to help with hearing the accompaniment and to check on whether the notes have been learned correctly, but does not use this to listen to other peoples interpretations. She would prefer to interpret this herself as well as memorizing the music (line 163-167).

ED sings in various styles including classical, Broadway, and jazz (line 179-180). She approaches the memorization of different styles of music in the same way as her description of classical music (line 185-186). ED had months to prepare for the performance of the Bach cantata, but was able to learn it in a few weeks (line 188-192). Overall ED finds the process of memorization a difficult one, because she "labors over it." She is uncomfortable if the piece is in a different language for which she will work over the translations and the meaning. The operatic is more difficult for her. English is much easier (line 202-206). ED continues to perform from memory on a weekly basis (line 208-210). She is most anxious in advance of a performance until she is ready to sing. She feels that she is successful at it. Each week she is anxious and the process of overcoming nervous energy is repeated (line 215-219).

ED talked about her nervousness and anxiousness in performing. She maintains that she has always been nervous before a performance. ED enjoys performing however and gave the analogy that it was like diving off a diving board, in that once you have jumped there is nothing that you can do to reverse it. Once you are performing there is nothing left to do but perform (line 231-233). ED has more confidence in performing than in the memorization process. She gave the example of in a performance setting not knowing what was supposed to come next, and she made up words even in other languages (line 233-237). ED performs for mostly an older aged audience and feels good that most of her concerts have been sold out (line 241-246).

Basic Information and Background

LE is a right-handed young woman who was 18 years and three months old at the time of the interview. She was one of my more talented students in the music program at the school in which I taught. LE is active in sports where in her senior year she won the recommendation of her peers as the most talented female athlete. She was involved in music, but was also apparently gifted in art as she showed me some of her drawings and sculptures. LE began playing piano at a young age but did not study privately in a consistent way. She however considered her primary instrument to be the flute. The study of the flute began when she was nine. LE is Caucasian and of Italian background, both parents are first generation, though her father passed away when she was ten. She is now in her third year of a U.S. University pursuing a possible career in the medical field.

Interview Analysis

When asked about her process of memorization, LE's approach is to "play the whole song through several times and then break it down into separate sections" (line 7-8). This was said with regard to her memorization on the piano, not the flute. LE begins with the right-hand (line 21) and observes the melody, playing it through numerous times (line 22). She would repeat this process with the left-hand (line 23). The process would be repeated a third time, now with both hands (line 24). When LE was at a comfortable level in memorization she would break the piece down into smaller sections until each section was performed smoothly (line 24-25).

LE was asked to memorized in this fashion when studying piano privately (line 30). She commented that an average piece given to her by her teacher would require approximately a week to memorize (line 30-31).

During a discussion on the evaluation of memory success, LE commented that she knew that she was successful when "your hands kind of just play it." She uses a kinesthetic approach to memorization (line 39-43). Continuing in this way LE commented that her success lies in the fact that the piece is smoothly played and there is a lack of hesitation in the performance (line 49-50).

The question was raised about musical elements (notes, articulation, dynamics, etc.) when memorizing a piece of music. LE considers the notes primarily, and will attend to the other elements when a good grasp of the music has been attained (line 58-60).

The concept of being distracted during the process of memorization was explored. LE first commented that she would start all over from the beginning (line 71). When further questioned however she claimed that she would start the process from the beginning of the section (line 76). Once a piece is learned and a distraction occurred during playing LE is able to begin in the section where the distraction occurred (line 82), unless it proved to be too difficult at which point she would begin again at the beginning (line 88-89).

LE is not distracted easily by outside stimuli (line 98), but may get distracted if she were tired and made similar mistakes over and over (line 99-100). A discussing ensued regarding the difference in how severe a distraction might be if it were a spoken distraction or a musical distraction. LE commented that she would find a musical distraction more disconcerting than a verbal one. The musical distraction creates more of a disturbance for her because she would "always have to think about what's playing" (line 109-110).

LE and I discussed a previous subject regarding the elements of music and their order in the memorization process. For LE, first each hand individually would be memorized, then the hands would be played together, then the other musical elements would be added (line120-121).

LE was able to perform successfully by memory two or three pieces at the time of the interview which was 28 April, 1998 (line 130). She was asked about playing different styles of music. LE plays different styles of music using various lesson books (line 134-135). The process of memorization for LE would be the same regardless of style (line142). When asked about a time frame concerning memory and the memorization of new pieces, LE felt that she was not able to comment (line 149-151).

When we spoke about the ease with which she was able to memorize, LE claimed that it was "easier to memorize a piece than to read the music" (line 155). She found it more difficult to learn a piece initially than to commit it to memory (line 159-160). LE further explains that when reading music, she needs to watch her hands where it is easier for her if the piece is familiar and she wishes to memorize it (line 164-165). She finds the memorization

more difficult if there are style changes or if the piece is lengthy without repetition (line 172-173).

LE and I spoke about long-term memory and music. She feels that she is "pretty successful" (line 185) when a long period of time has passed and she wishes to play a piece from memory. She would need to brush up, but feels confident that she would be able to perform it again after a few times of going over it (line 185-188). She feels that her memory for music is equally as good as her memory for regular academic work (line 195-196).

Confidence in LE's ability to memorize is very important to her (line 201-202) and that confidence in performance is even more important (line 207). Confidence is an integral prerequisite to perform for someone successfully (line 207-210).

Her examples of songs that she was able to play by memory reflect a usual approach taken by piano instructors. There were popular pieces, classical pieces, and those that were written by authors of method books. She has performed in recitals and contests, where her musical memory was called into play (line 240). The interview took place near a piano, and at the end of the interview I asked her to play a piece by memory. She played a piece called "Dangerous Journey," but was unable to recall it totally (line 281).

5.1 (b) Subject Narratives

Basic Information and Background

Ana-Maria Trenchi De Bottazzi is a right-handed professional concert pianist/teacher. As noted elsewhere she has agreed because of her notoriety to allow me to use her name in this document. She is Argentinean by birth and was born in that country in 1938. Ana-Maria has given concerts in many countries throughout the world and has performed at Carnegie Hall over 15 times. Her mother who was also a professional pianist began giving her lessons when she was two years of age and she gave her first recital at age 4 (line 2-5). Ana-Maria was asked to practice for two hours a day until she was six, then four hours a day until he was 9, six hours a day until she was 12, and 8 hours a day since (line 13-15). Ana-Maria was tutored until 12th grade and did not attend school (line 7). During this time in high school , she studied for a time at the Paris Conservatory (line 34-35). This was decided by Ana-Maria's mother who impacted her life in many ways (line 15-32). Ana-Maria has written a book called "To Live Again" which is the story of her life and includes her early beginnings in music as well as her accident and subsequent rehabilitation. She has impressive academic credentials and has earned two PhD's, the first from Catholic University in Buenos Aires (line 40) and the second from the Juilliard School in New York (line 75-186). After her marriage Ana-Maria moved with her husband to the United States settling in Missouri and received a scholarship from Washington University. Eventually they both received full scholarships and settled in Stony Brook (line 45-53) where she commuted to Princeton to teach (line 54). She now is a well respected teacher and performer residing in New York.

Medical

Ana-Maria's accident occurred on December 7, 1961. She had just finished a European concert tour and was traveling to Paris to vacation before her first American tour. During a snow storm in Belgium her car went out of control and hit a truck which was cleaning the streets and had stalled blocking the road. At the last moment she decided that she should above all save her hands, so she calmly put them in her lap and waited for the crash. The accident fractured her skull on her right side. Cerebral spinal fluid flowed from her nose and

because of this she contracted meningitis. Her sight was almost totally impaired and a right sided hemiparesis followed. Ana-Maria had fifteen blood clots that were pressing brain tissue in the left-hemisphere She also lost four of the five languages she was fluent in, including her native Spanish (line 380-382). She was operated on once the meningitis was under control. However before the operation her condition began to deteriorate. She became totally blind in her right eye, and experienced a total right-sided paralysis. Her mother had flown up from Argentina but was not recognized by Ana-Maria. After the operation, she was able to recognize her mother and was able to respond in her native tongue. In addition the paralysis was gone as the chips of her skull and the fifteen blood clots were removed from the brain. After an extended period of time in rehabilitation, the final results which the doctor had explained to Ana-Maria is that she had permanently lost her sense of smell, and that in his opinion her memory had been permanently damaged. This damage would affect both short and long-term memory. He did not think that she would be able to memorize music any longer. In addition her motor skills were affected by the trauma and subsequent operation.

Interview Analysis

Ana-Maria was asked if she had any recordings of her music at which time she gave me two CD's and a video of a recent performance at Carnegie Hall with her husband conducting the orchestra (line 194-206). She explained that because of her medical difficulties she needs to walk across the stage with a cane. Ana-Maria had lost a great deal of money because of a concert that was scheduled that she was forced to cancel because of medical problems (line 222-228).

After her accident of December 7, 1961 Ana-Maria explains that she could not remember anything. Her memory was so damaged that the doctors would allow her to eat a few bites of food, then turn her around and ask what she had been eating. She could not recall (line 239-243). It took her 13 years to begin to play the piano again, but still she could not remember what she was playing, or at what stage the learning process was at (line 244-247). Ana-Maria considers herself to have a well trained auditory memory. Because of her training in solfege she has the ability to sing most any melody in solfege thereby assisting in the

learning and memorization processes (line 250-256). Ana-Maria has a photographic memory which was developed formally by her teacher in Paris. In the beginning she would be asked to duplicate a one line piece of music and was given five minutes to do this. Each and every musical element was required to be there (line 256-264). Still to this day, when she reaches the end of a page, she envisions in her mind the page actually turning (line 266-268). Ana-Maria gave an example of relearning a piece she had not played for quite some time. The edition used when she was younger was different than the current one. The format therefore is different as is the point when the page needed to be turned. Ana-Maria became confused because she remembered the markings due to her excellent visual memory which were different in the new edition (line 268-276). She acknowledges that she uses a variety of memories when she performs. She incorporates motor, visual, and auditory memories which assist her in the overall process (line 277-280). Ana-Maria admits to being frightened at a performance because of the memory lapses which sometimes occurs. She uses this eclectic approach so that if one of her memories fail her, she has others to back it up (line 285-288).

For Ana-Maria her visual memory is the strongest. She feels secure in seeing what she is doing. For her it is like having the music in front of her (line 291-292). As a young person Ana-Maria was an avid reader. She noted that in one book it recommended that you should visualize things that need to get done. For instance, if you want to remember to get the mail, you visualize passing the mail four or five times and picking it up. This will assist you in the actual remembering (line 292-297).

Ana-Maria uses the handicap she has to her advantage. She uses the things she has learned to counteract these disadvantages (line 296-298). Ana-Maria shared with that seven years ago, she was operated on for breast cancer. She could not play for three or four years, because in the operation they severed the nerves under the arms. Due to this she lost sensation in part of her arms and hands. Ana-Maria had other medical procedures performed, but refuses to allow these misfortunes to hamper her spirits (line 299-320). Besides the photographic memory mentioned before, Ana-Maria also possesses absolute pitch (line 322-324). At age two her family reported to her, that she was able to find middle C on the piano and then play a C major scale in contrary motion (line 325-342).

We discussed motor difficulties after the accident. Ana-Maria felt that the amount of difficulties were "tremendous" (line 347). She would know that a certain fingering should be 1,3,5....but it would translate to her fingers as 4,2,3. Ana-Maria felt confused because the brain was saying one thing and the fingers would do another (line 347-354). At one concert playing a piece by Mendelssohn she became paralyzed with fright because of a lapse of memory regarding the finger not moving as it should (line 355-356). Ana-Maria did not sense any auditory problems after her trauma (line 364- 366). However visually as stated before she was blind due the blood clots pressing against the brain. Ana-Maria also lost the ability to understand four of the five languages she spoke (line 379-392).

The question was asked what her specific processes are in memorizing music. Ana-Maria uses many strategies in this process. Once is to see the piece without rhythm. Then she uses 20 different rhythms and plays a page of the piece 20 different ways. She then moves on to the next page. She does this 15 times with the 20 rhythms in each page. Usually after five times she has it memorized. Ana-Maria puts together a map of the piece in her mind. She learns the map and demonstrates what she is doing with her hands (line 398-407).

Ana-Maria's training was so extensive that she studied with her teacher at the piano 35 hours a week for ten months a year for five years. She feels confident that when she left that teacher she knew all the standard piano literature from memory (line 412-425). The concept of harmonic analysis as a tool for memorization is utilized somewhat by Ana-Maria. She does know where she is harmonically. Ana-Maria possesses such a good auditory memory that she does not need to rely on this specifically (line 429-434).

Other styles of music besides classical are played by Ana-Maria, but she admits to not being very good at improvising though she loves the jazz idiom (line 453-460).

Basic Information and Background

CCT is female and was 18 years, 10 months of age at the time of the interview. She is right-handed and is of Hispanic/Latino descent being born in Columbia. CCT is both a pianist and vocalist. She began her studies on the piano in 1990 but had stopped a year or so ago. CCT attended schooling in her area from the primary grades and is currently a first-year student at a university in upper New York State.

Medical

CCT and her family were on holiday in the UK when on July 15th, 1995 she began to experience a severe headache and collapsed. She was rushed to a hospital in Oxford where the medical documents state "CT scanning confirmed a large haematoma in the right temporo-parietal region with a secondary rupture into the fourth and lateral ventricles; there was also an obstructive hydrocephalus." "An angiography revealed a small anterior venus malformation located in the posterior, superior aspect of the right temporal lobe.....the hematoma was evacuated and the AVM excised." Conclusions drawn by the hospital stated that, "CCT's left hemi-paresis, visual field defect, unilateral neglect, and impairments in prosody and long-term visus-constructive memory, and not inconsistent with the site of her lesion."

Interview Analysis

The beginning of our interview was an update of her life after our previous conversations and we discussed her surprise marriage and subsequent stay for a suicide attempt and stay in a psychiatric hospital (line 1-19). We then discussed her trauma which concurs with the above medical report. She states that she was feeling very cold, she began to go downstairs to bake but found herself running back upstairs screaming with a severe headache (line 24-26). CCT explained to her mother that she felt her leg was paralyzed as she could not feel the leg. Shortly thereafter she lapsed into a coma. They ran tests at the hospital performed emergency brain surgery and found that she had an arterial malformation which had ruptured. CCT remained in a coma (line 26-32). She affirmed that the part of the brain affected was the right temporal lobe which they excised (line 34-45). Naturally she has few

memories of the event and those that immediately followed. CCT was in the hospital for five weeks and was taken to a Traumatic Brain Injury Unit in New York (line 49-53).

CCT explained that she experienced left hemiparesis for a time and still suffers from left hemispheric neglect as she finds herself crossing over to accomplish a task rather than using her left side (line 63-68). She currently wears an orthotic on her left foot due to poor plantar flexion (line 72-78). Due to the surgery she does not possess left peripheral vision. CCT has learned to compensate, but she is not able to focus straight ahead, for her eyes automatically shift (line 82-92). After the operation she suffered from severe visual spatial problems. CCT is unable to read maps, and has much trouble with puzzles and sequencing events (line 97-99), though she is able to reach out and grab an object (line 101-103). She did not lose any auditory abilities due to the stroke or the operation (line 109-111).

CCT was asked to describe the changes in her normal daily activities. She indicated that she went back to school in December of 1995. At first CCT was unable to walk and used a wheelchair at home. She found that she was able to walk with braces upon her return to school and utilized a full-time aid as she was experiencing severe visuo-spatial and orientation difficulties (line 130-133). School tests needed to be reformatted and she always found it difficult to read music especially with these added handicaps. CCT can play music by ear, and is successful at memorizing music. She would have to learn a piece measure by measure until she could put it together (line 133-137).

Her formal private music studies ceased in her senior year of high school as CCT found herself very busy preparing for college (line 143-145). She still enjoys playing the piano informally and noted that she has memorized almost everything she has ever played since she began her studies at eight-years old (line 143-147). CCT always preferred memorizing her music because her reading ability was so poor (line 153-156). She was asked if anyone was able to find out why she could not read music. CCT responded that she apparently had the arterial venal malformation since birth. This abnormality does not allow oxygen to the part of the brain affected, in addition to that specific area not being fully developed (line 160-163). Conclusions as to the possibility of her not being able to read music due to the arterial venal malformation has not been explored to my knowledge.

CCT is still able to memorize but appears to take a little longer than it did before the operation (line 169-177). She admitted that the memorization process is still the same however. The difference noted for CCT is that she was able to keep a piece in her memory for a longer period of time whereas now she needs to play it often even after memorization, otherwise it would dissipate (line 181-184). CCT can remember pieces she memorized when she was a young as six years of age (line 186-189). She admits to having problems with her short-term memory especially with names and faces (line 193-194). CCT does feel however that over time, her memory skills have improved. She uses repetition primarily as way to remember. Now that she is studying at a university, the amount of information in a textbook at that level is very difficult for her to grasp. CCT has difficulties seeing the bigger picture. She utilizes outlines to study by or some other tangible structure (line 203-209).

As a student musician CCT accompanied her school choir on the piano the year prior to the manifestation of her trauma. The year prior to that she played in a piano quartet at a school performance as well as recitals which her private instructor organized as a way to showcase her students (line 214-217). After the operation she continued to play for the choirs, though in her senior year in high school she stopped playing the piano altogether. CCT continued however to sing in concerts and to be involved musically on that level. After high school however, even this ceased because of the more competitive nature of university life (line 221-223). She felt that being able to memorize successfully is a good skill to have because as she explained by way of an anecdote, that one young man who was also an accompanist for the choir dropped his music during a concert. He was unable to continue whereas if the same thing should happen to her she would keep on playing (line 225-229).

In terms of her process of memorizing a piece of music, CCT studies the piece measure by measure, one hand at a time, then putting the two hands together. Once that measure is learned she would move onto measure two and so on (line 234-236). Each time, she returns to measure one and not where she may have left off (line 239-255). If distracted CCT needs to begin again, as she would not be able to remember where she left off (line 257-261).

CCT primarily played classical pieces, some baroque, and romantic. Composers played for her private piano instructor were Beethoven, Haydn, Purcell, and Gershwin. There were other lesser known composers for accompanying the choir (line 268-271). CCT explains that

her private teacher realized that reading music was too difficult for her, so the teacher would play it for her. CCT's ear appears to be fairly well developed and would learn the piece by rote, as the piano instructor would play a passage for her to learn. She would rely on hearing it, to learn it (line 276-282).

If given a new piece of music to memorize CCT would learn the right hand to ascertain the melody, then the left, and go measure by measure. This she feels would take her a very long time (line 292-298). CCT never paid much attention to dynamics or other elements in a piece as she would merely interpret these elements and insert them where she thought they should be. The only time these elements would impact her playing is if she was going to perform in a recital of some kind (line 305-310). CCT had sent me a written evaluation of a performance for voice when she attended a festival called The New York State School Music Association. This festival is a yearly activity that occurs all over New York. Young people of any age can learn and practice a solo and perform it for an adjudicator who gives them a rating. CCT sang a piece called "Tell Me, O Blue Blue Sky." Each piece is rated according to difficulty level. This piece is rated level VI, which is the most difficult. CCT received a 96 points out of a hundred (312-326).

CCT does not enjoy performing in front of people because of nervousness (line 326-328). She feels that she could probably perform over ten pieces successfully by memory (line 330-333). CCT primarily has studied classical music with an English piano teacher (line 337-341). She feels that she would need a month or so to memorize a piece. CCT admits to not practicing as she should. While she enjoys the playing of the piano, the practice sessions were not so enjoyable (line 343-347). CCT finds the process of memorization an easy one, and enjoys the fruits of her labor by being able to play the piano (line 349-355). CCT has trouble with long-term memory for music. She seems to be able to learn something in short-term, but if she does not constantly play it, she will lose it over time (line 360-362).

While in the hospital she remembers the doctors giving her the hot/cold test on her feet. She had little or no sensation on her left foot for quite some time. She also remembers an incident in the hospital where her father asked her if she was able to move her arm, and she told him that it was not her arm (line 367-372). CCT was asked to rate her ability to memorize pre and post trauma. Before the trauma she had no problems memorizing. Afterwards

however, it took much longer and was much more difficult (line 381-389). We then talked about confidence and its importance in the process of memorization. CCT acknowledged that confidence is most important and gave the example of her younger sister who gave up the piano quickly because she lacked this element (line 401-406). She also feels that confidence is most important in the ability to perform in front of others (line 410-411). CCT felt rejected on a social level after the trauma. She had been president of her class from fourth to seventh grade and received numerous cards and letters from classmates upon her return from the hospital. After a while her changed behaviour which now was disinhibited began to show, and many of her friends disappeared (line 415-422). Her favorite music is hip hop and R&B, and has been since she was ten (line 424-431).

Pieces which CCT is able to perform from memory include "Sarabande" "Horn Pipe" by Purcell, "Scherzo" by Haydn, "An American in Paris" by Gershwin, and on the popular side, "Somewhere Out There" from the movie "The American Tale" (line 440-442). She feels that these pieces are of medium difficulty. When memorizing CCT does not use any visual tricks because her visual memory is relatively poor (line 457-459). She appears to have good motor memory in that she claims that she can play the memorized pieces which her eyes closed, as well as dialing a phone without looking. She can also tell who someone is calling by the beeps the telephone makes when dialing (line 463-468). CCT can tell the sound of a note before its played but does admit to needing a reference point at times (line 474-480).

Basic Information and Background

JJ is a right-handed male Caucasian who was 39 years of age at the time of this interview. His primary instrument is the cello, but he is also proficient on bass and viola. JJ began his musical studies at age 8. He was unwilling to answer certain questions regarding his background and would not allow me to contact any relatives or friends so the information gathered is limited.

Medical

JJ would not allow me to contact any physicians regarding his trauma, therefore the following is all based on what JJ himself has revealed. In May of 1992 JJ was involved in an automobile accident where he fractured his skull in the left-temporal area. He suffered a subdural hemaetoma, fractured his scapula and pelvis, and subsequently began to have seizures. JJ continues to suffer from neck and shoulder pain.

Interview Analysis

JJ was asked about the changes he perceived after his trauma. He commented that he has constant headaches since the accident in which he broke his neck. JJ also suffers from soreness in his neck and shoulder areas (line 10-11). His recall of items in memory are slower (line 11), as is his word recall (line 12). When in conversation, words which he would normally use in conversation would be retrieved much more slowly than prior to the trauma (line 12-15). JJ does not feel that it was his short-term memory that was affected but his linguistic memory i.e. words and names (line 17-20). He also does not feel as if his music abilities were affected (line 22-24). JJ was asked about any motor difficulties. His only physical problems was the soreness in his arms and shoulders (line 26-28).

After his accident they fitted JJ with a brace which is attached to the skull, preventing any movement of the head (line 32-34). He had a seizure and was given Phenobarbital, which he took for a year and a half (line 35-36). JJ was unclear as to the type of seizures or their

origin. He did not perceive an auditory changes (line 38-44), nor any sensory changes (line 46-48).

JJ wore the large brace for three months (line 53), and then wore a neck brace for a couple of months after that (line 53-54). Being immobile, his muscles atrophied (line 54-55). The Phenobarbital caused tiredness and sluggishness (line 62-64).

JJ did memorize music prior to trauma (line 67-69). He is a classically trained musician (line 73-74). JJ contrasted the differences in which classical music is memorized with how jazz is memorized. For JJ jazz is based on chords and harmony (line 74-76), as opposed to memorizing melodic lines (line 76-77). JJ was asked about his processes of memorization for classical music. His process is as follows: he will play through the music once (line 84), then he will put the music away and physically move the book to the other side of the room and attempt to play it again (line 85-86). When it came to a section he could not remember he would go once again and look at the music (line 86-87). This was a recommendation from one of his teachers (line 87-88). He would repeat the process (line 88-89). His other method was to sit with the music and piano and while learning the music, sing it (line 89-90). JJ gave the example of learning a Bach solo cello suite, his teacher told him that he should play it once through, then sit at a piano and sing it through. He would then memorize it, learning it like a song. Then he would sit with his cello and play it. (lines 90-93). All of his classical memorization took place on the cello (line 95-98). He only memorized for specific reasons and would just play chamber music on bass without memorizing it (line 98-99).

When thinking about memorization and the elements of music JJ was at a loss to explain his process as he mainly worked on chamber music and did not need to memorize (line 116-119). JJ explained that when he did memorize he was in college or preparing recitals (line 123-124). He felt his memorizing of jazz was more important (line 124-125), because he was preparing for club dates, and jazz gigs and knowing all the songs intimately was paramount (line 125-127). JJ needed to know the melodies (line 127-128), and the chord changes (line 128). He worked on transposing them (line 129). After he would learn a tune, he would try and play it through all 12 keys (line 129-130). JJ further explained that when memorizing a jazz piece he is memorizing a page of music (line 136-137), but in memorizing a classical piece the

melodic line keeps going (line 138-139) and there are many more sections (line 139-140). The chords and sections of classical music are thought about differently by JJ (line 145-146). JJ breaks a classical piece into definite sections (line 151). He contrasted this with knowing that you were coming to the bridge section of a jazz piece (line 151-152). It is not sonata-allegro form, and although there are sections, JJ does not memorize it in exactly the same way (line 152-153). JJ was asked how long the section of memorization might be in a classical piece. His response was an eight-bar phrase (line 158). JJ would approach this melodically first, though he would note what was taking place in the accompaniment (line 162-163). At this point he reiterated that his main memorization at this point was jazz and pop music (line 163-165).

JJ does not use visual memory in these processes, but prefers the auditory (line 170). I asked him why and his response was that it is music, not a painting (line 172-174). He was asked if he used auditory aids like a take recorder, but he preferred singing (line 176-178). JJ maintains that singing assisted him in memorization. He noted that when you sing something you "remember it forever." (line 178-180). JJ was asked about the ease in which he memorized prior to the trauma. He found it difficult and had to work hard at it (line 182-193). I asked him about the times when he needed to memorize a classical piece, whether or not the other elements of music were a part of his process. JJ felt that this was instinctive (line 199-203).

JJ did teach prior to trauma (line 205-207, but as of two years ago stopped his teaching of private lessons (line 209-212). He was asked about his current processes of memorization to which JJ responded that he would use the same processes he has always used (line 214-220). He explained that when he plays in the pit he is playing bass and therefore playing chordal changes and not melodic lines (line 224-226) He is concentrating on the harmonic changes and memorizing the just the notes but the whole thing (line 226-228).

The question was raised about the success of memorization. I asked him about what would upset his feeling that he memorized accurately. JJ said that he would be upset if he missed audible cues, because he feels like he should be listening very attentively and was not (line 242-244). JJ performs various styles of music (line 246-248) and plays a lot from memory because he is involved in pop bands and stage shows (line 253-254). JJ spoke about

the concept of chunking and how one chunk of information can stand for a series of notes or chordal movement. He gave the example of a typical chordal series D minor to G^7 to a C. JJ maintains that for him that series of chords is one whole chunk because he thinks of it as a very typical II-V-I progression (line 261-263). He further explained that when he taught, he would demonstrate to his students that when you look a page of music and saw the word OMNIDIRECT he would not see the letters individually, but see the whole word OMNIDIRECT (line 265-266). An important part of JJ's memorization process includes this idea of chunking, and that the above example of II-V-I becomes one chunk rather than three separate chords (line 266-268). It is just like playing the blues to JJ, you never think of the individual chords but only that you are playing the blues which is one thought (line 273-274). He uses the idea of chunking on a bigger scale (line 272-273).

Right before our interview JJ was playing in a band where they primarily performed from memory (line 284-285). During our interview JJ was a pit musician in an equity theatre in New York and so rarely played from memory. He did give an example of when he did memorize in the show "The Best Little Whorehouse in Texas" during the song "24 Hours of Loving" where six girls were in lingerie. JJ felt inclined to memorize this portion of the show (line 292-296). JJ mentioned that the written music was written out in much too complex a style. He used his musical expertise to simplify and make it more musical. JJ prefers to play the show stylistically rather than read every note, since most times the part was not written by a person who plays that particular instrument (line 303-308). He further explained that in the current show of "Pippin" the problem was similar in that the bass part was very "busy" and not very musical (line 313-315). When he compared what was written to the Broadway recording he noticed that the bass player on the CD had simplified, as he was currently doing (line 315-317). Once he focuses on the harmonic structure of the show he can memorize music more quickly (line 317-319). JJ memorizes when the situation arises. He does not consider himself one who memorized frequently (line 323-324). JJ tries to get off book as soon as he is able because his playing becomes freer (line 333-334). He thinks auditorily and not visually (line 335-336).

Confidence is important to performing because "if you're not confident, you're gonna play like you're not confident." (line 341-342). We discussed the idea of confidence further,

and JJ brought up the fact that when he was in his twenties, he had a liver transplant (line 347-348). He feels that this affected his confidence because he was consistently sick during this time (line 348-349). JJ's lost a lot of weight and became jaundiced right before his transplant (line 350-351). After the transplant his health greatly improved and he began to feel much better physically (line 351-352). One year later he went through his accident (line 352-253). Though he considered it a setback, he does not feel that affected his confidence because he had been through so much before (line 354-356).

The question was asked about musical taste pre and post trauma. JJ maintains that his musical taste was not affected in any way by the trauma (line 362-369). We discussed composers and his preference in listening. JJ enjoys Ravel, Schubert, and Beethoven (line 371-375). He played a lot of Beethoven because he played a lot of string quartets of which Beethoven was a favourite (line 375-376). JJ does not enjoy country music, but does enjoy Irish music (line 376-390).

We began a discussion of the idea of muscle or kinesthetic memory. He agreed that he uses this type of muscle memory frequently, especially in a louder pop style group where he may not even be able to hear himself (line 419-430). I gave the example of a Chopin piece where I could feel the run in my muscle memory, chunking it. JJ agreed that there are similar patterns that just "fall under my hands" where the notes disappear but the chunk remains and is articulated (line 443-446). He instinctively breaks it down into chunks, arpeggios etc. (line 450). JJ will hear a certain sound before the pitch is heard (line 450-451).

In the next few minutes JJ explained his performing lifestyle and the kinds of musical performances he has been involved with, from touring Broadway musicals to Top 40 (line 479-489).

Basic Information and Background

LH is right-handed male Caucasian who was 52 years of age at the interview. His primary instrument is the guitar which he began to study at age 16. LH also plays the electric bass and the mandolin. LH grew up in the Philadelphia area where he went to Elementary, Junior and Senior High Schools all of which were parochial . His first experience of music occurred when he was eight years old when he was encouraged to join the church boys choir in West Philadelphia with a priest sent by the Vatican named Father Angelo dello Pica. This priest was the former director of the Vatican choir (line 6-16). There LH learned basic forms of reading music, but was asked to primarily memorize the music that was learned which was mostly Latin (line 20-23), but they needed to also learn other European languages as well (line 23-25). They would perform in the church each week (line 25). There were a few years in which the string section of the Philadelphia Symphony Orchestra would accompany the choir. LH was a member of this choir for six years (line 29). He considers himself having a good ear, as LH was able to hear the harmonies, and know the different parts before the actual teaching of it, hearing it in his head (line 29-33). He recalls an incident on Christmas Eve when he was quite young. It was very late being a midnight mass, and being young and very drowsy, he feels that he had an out-of-body experience. He would wander over to the different sections of the choir and sing each of their parts (line 34-41). LH began to become involved in teaching other young men about harmonies and they began a doo-wop group (line 41-45). He decided that he should really be studying an instrument. LH received a guitar as a present when he was 13 (line 46-50). He began to teach himself listening to the musicians of that era; Peter, Paul and Mary, Simon and Garfunkel etc. (line 51-54) and considers himself fairly adept. At age 16 he began to work as a musician in Philadelphia and played many lounges and coffee houses (line 54-77). After a stint in the army (line 78-82), he ended up in the San Francisco area playing as a musician (line 83-103), where electric guitars were taking the place of the acoustic sound. LH continued learning and practicing joining groups and performing (line 125-155). He is currently finishing a recording of his original music, where he plays many of the instruments and also sings.

Medical

LH moved back to the east coast after marrying and having a daughter, as both husband and wife are from the east coast. To supplement his musician's work he got a license to drive large trucks. He began work for a large company in New York driving an 18-wheeler (line 172-180). The company was secure with excellent benefits. This job began in April of 1986. On September 4, 1997 LH was operating a forklift to move large 12' vinyl siding in boxes to the forklift. He noted that there was much soot and dust on the boxes. He fell off the forklift which was approximately 12-13' up in the air and hit his head on the large iron bar extending armlike out from the body of the truck. LH was immediately brought to a local hospital. This next section is taken from a medical document written by LH's Neurologist, "On the day of the accident, a CT scan revealed a right-sided acute subdural haematoma in the temporal region with an associated right temporal lobe contusion/bleed. There was layering of blood across the tentorium. There was also a left temporal lobe contusion, bleed, a right parietal bleed and a left inferior frontal lobe bleed. There was some compression of the third ventricle and very subtle shift. There was a right temporal bone fracture. He has considerable right shoulder pain and has noticed that his right shoulder is drooping. The shoulder pain is worse in the morning and worse with movement of the arm and it is localized to the anterior shoulder and proximal arm region. He has not had neck pain and has no cervical radicular symptoms. He has no low back pain and no lumbar radicular symptoms. He has a sense of decreased hearing in his right ear and hears a clicking noise in his right ear. Hi has no tinnitus. His voice has been raspy and sore, and it is easily strained and he is unable to sing, even though he is a professional singer. He has had difficulty swallowing liquids and he feels a tickling sensation in his throat and will cough excessively upon swallowing liquids. He has been forced to swallow semi-solids and thick liquids. The patient has a sense as if he is spinning internally when he gets up suddenly or is he suddenly extends his neck. When he is walking, he has poor balance and he feels that he can suddenly veer to one side or the other. He has been unable to ride his bike, even though he was an avid bike rider prior to the accident. He has not felt safe to drive a car. He has had work-finding difficulty and

occasionally has paraphasic errors. His short-term memory has been poor, especially with new names and stories."

At the hospital LH's wife who is in the medical field recognized immediately that LH had a fractured skull, because the blood had sunk down behind the eye socket, which is known as raccoon eye (line 203-214). LH was in a coma for approximately 10 days (line 236).

Interview Analysis

LH talked about the stages in the recovery of brain damaged individuals. He went through the anger stage, and disoriented stage (line 295-303). He gave an example of the third stage which is disinhibition. This is where you revert back to pre-adolescence, where life is like an adventure and where inhibitions are absent (line 307-309). He related two incidents where in public he acted in this manner which was disconcerting and embarrassing. In the first LH was touching an antique table with a small box on it. He dumped out the expensive items which proceeded to roll off the table and onto the floor where some disappeared. When he saw the lady come near with arms folded he "felt like a child again." (line 318-329). The other incident concerned two Hispanic men who were dressed identically, yet one had shaved his head while the other had dreadlocks. He innocently asked them if they got their haircut at the same place. His wife immediately took him out of there and explained how they might misinterpret his comment. LH realized the implications and wanted to apologize (line 330-348).

A problem presented itself upon his return home from the hospital. He noticed that if his wife or daughter turned their heads during a conversation or left the room, words were dropping out. His hearing had definitely been affected (line 371-376). LH had his hearing checked at a local hospital where it was found that he had a moderate to severe bilateral high-end hearing loss which may have occurred due to the strong antibiotic given him when he contracted pneumonia (line 387-401).

LH talked about his state of mind upon his return home. The house was a new one for the family. He experienced great joy at being in the new home, but suffered from disorientation and confusion a great deal as well (line 412-430). He related an incident where he inadvertently set off the house alarm and because of his condition could not remember the

password, at which point the police are called. Between the alarm going off and the dog having an accident, and the police arriving LH lost control and could do nothing but sit there and cry (line 432-446). Shortly after he received a call from a neuropsychologist from a hospital nearby and was told that the insurances would pay for his rehabilitation if LH would join their program. He joined and began to have rehabilitative measures taken, including physical therapy, speech and hearing (line 450-477). LH uses micro-sized hearing aids which are almost non-visible (line 489-495).

LH has had some balance difficulties which made him fearful of falling. Although he was in excellent physical condition and had been an avid bike rider where he had been riding 7-8 miles a day for the last three years, he was reticent about starting up again. He is much more secure now as he has been working on balance especially since he has been taken off medications this year (line 518-524). Though he is not riding as much as he used to, he has five acres accessible to him beside his home which he can ride in without the worry of traffic. He is "feeling very confident and very good about things" (line 579-584). In the summer of 2000, LH was asked to audition for a stage show called the "Patsy Cline Show". He was accepted into the group, his first professional job since the accident. He played the guitar for the show on weekends for four weeks. It made him feel great that he auditioned, performed, drove himself during this time after a life threatening trauma (line 564-575). We spoke about a vision problems, but LH admitted that this was not an area in which he experienced any difficulties (line 588-590).

Post trauma, LH had severe memory problems. He was able to identify family members, and was able to remember most people's names (line 608-610). If he did not make specific notes about things he would not be able to retain it (line 620-611). LH had problems reading, as his lack of being able to retain information caused the feeling that this information was garbled (line 611-613). He is an avid reader, but soon realized that his was not retaining any information and then becoming disoriented (line 613-617). He did not read for about three months (line 617-618). Around Christmas of 1997 he realized that he was retaining more information and felt that this area was on the mend (line 618-619). During this time he began to play the guitar once again, though still having a slight problem remembering lyrics he had written years ago. He felt very fortunate that he had written all his lyrics down (line 620-633).

LH was very uneasy about whether or not he would regain his memory (line 646-647), because he would start to sing and draw a blank on the lyrics (line 648-650). He recalled that prior to trauma when he was performing, he could get up and sing for four hours with only a list of titles. The lyrics would all be remembered (line 651-655). A speech pathologist/voice teacher recommended that he organize his book in a way that would benefit his difficulty. He would use colored markers to identify the song title. Then to go home and pick out a song reading the lyrics, singing it until there is a feeling of confidence. Then to try and do it without the lyric sheet. After a year of doing this he felt that his memory skills were increasing, and found that even newer songs were being remembered (line 663-674).

LH feels confident that his faculties are being regained. A friend of LH who is a musician commented to LH that he thinks that his performance ability is actually better than pre-trauma. He is very thankful that he is still able to perform. Another friend asked him to help on a recording session which went very well. LH was deeply moved that he regained enough of his facility to play well enough to record (line 691-708).

We discussed LH's memory and how he utilizes it. When he was asked to play an audition for the "Patsy Cline Show" he went to the library and took out a CD of her greatest hits. He listened to this incessantly for a week playing along with it. LH was already familiar with the basic structure of the material and familiar with some of the songs themselves as they were hits when he was younger. He would take notes on the songs concerning special riffs or guitar solos. LH memorized the guitar solo and played it over and over until he had it totally memorized (line 722-729). At the time of the audition, he felt very prepared. They thought he had done a good job and hired him for the show. At each performance night he felt more confident and felt better about the experience (line 749-758). Though they did not have a budget that would allow a pedal steel guitar usually found in country music, LH utilized a special pedal and would strike the strings of his guitar to mimic the sound of a pedal steel guitar (line 758-763). He feels that the experience made him realize that he was very close to where he was musically prior to trauma (line 766-770).

LH being a guitarist begins the memory process with the chord structures and what the rhythm guitarist would play (line 778-781). Although he enjoys playing lead guitar at times, he feels that it starts with the chords and the harmonies (line 782-784). It moves from here to

the vocals, though he prefers playing guitar with the vocals instead of bass, because he feels that the bass is too percussive and gets in the way (line 786-801). The order for LH in terms of elements of music for memorization would be rhythm structure, the chord structure, rhythm, vocal and then melody (line 801-802).

We talked about how much material LH could play by memory. He thought that about an hours worth would be about what he could handle (line 807-808). LH would like to improve on that (line 809). LH began his music career as a folk player, who on occasion would play rock 'n roll (line 813) (853-864) though primarily he plays a lot of blues (line 813-814). LH played with a blues musician from California named Floyd Dixon (line 815), then played with a guitarist named Jerry Miller, for about five or six years learning a great deal because of the musicianship and ability of Miller (line 832-851). LH spoke about different musicians who have added to his knowledge of music (line 865-987). He enjoys playing bass on reggae music, because of the off beat rhythms (line 897-898). In the hospital LH learned a great deal about Mozart and how much a genius he probably was, and how amazing a legacy he has left for us (line 899-902). He has used the music of Mozart as a grounding tool, to release anxiety and to settle oneself (line 903-908).

LH described how he goes about the memorization process. He uses what he calls a 'subtle combination' (line 922). It is a combination of visual, kinesthetic, and hearing (line 923). LH is very aware of tone, of hearing things that he gets attuned to (line 923-924). He has very old acoustic guitars which have beautiful tone (line 924-925). LH described different instruments, microphones, and amplifiers which assist in this process (line 928-952). He feels that he becomes a better player, when the instrument is of a quality which gives you the sound you want (line 952-956). LH described how he remembers a memory of a certain time when the tone was perfect, the piece was played well, and he recalls it (line 974-979).

I asked LH about his particular choice of composers. He "can't not listen to Mozart." He feels that listening to Mozart gives him a broader horizon in terms of movement (line 984-986). LH continues to listen to all kinds of music and songwriters. Blue Grass, classical, and the blues are part of his listening choices (line 995-1000). He also enjoys Celtic music (line 1020-1027). For the next few minutes LH reflected on how he plans on continuing with his

music and selling his songs. He talked about contacts in Nashville and options that he is exploring (line 1029-1097).

Basic Information and Background

Pat Martino is a right-handed male guitarist. At the interview his age was 55 years 8 months. His stature and gait appeared normal. No general physical abnormalities were noted. He is slight in appearance which contrasts with his voice which is extremely resonant and deep and does not match his overall physique. Pictures of him growing up and until recently show him to be very slender and possibly underweight. Through reviews, recordings, and two videos of Pat one could visualize his appearance as it is exhibited chronologically. A recent meeting with him however demonstrated that a diet he has been on has increased his weight. I also went to see Pat perform at the Iridium which is a jazz/supper club in New York City on November 1, 2000.

Pat Martino grew up in Philadelphia on the south side where many diverse ethnic groups lived, and as you would find in many large cities. He grew up listening to music of the melting pot; tarantellas and polkas, doowop and jazz. Pat began to play the guitar as his father Mickey had. Pat Martino began his studies of the guitar at age eleven. Pat was very proficient on his new instrument at a very young age, and was performing in professional groups while still in high school. He left his academic studies to pursue a performing career. In the early 60's PM had played with Lloyd Price, Charles Earland, Bobby Rydell, Frankie Avalon, and Willis "Gatortail" Jackson (Machnie, 1977).

Pat explored many areas of music including Eastern, classical, and rock, but remains primarily a jazz guitarist. When Pat told his father that he also wanted to play the guitar his father conceded telling him that as long as he will "be the best that you can be" he will support him in his choice. When Pat was 11 years old his father took him to see the famous guitarist Les Paul. Les asked him to play something for him, and was amazed at the poised control and ability the young man possessed. Pat began playing professionally at a very young age and at 15 went on the road with the organist Charlie Earland. He began to meet and perform with some very excellent musicians like Red Holloway, Slide Hampton, Willis Jackson, Brother Jack McDuff, Don Patterson, and eventually joined the John Handy Band. He has performed on numerous albums, both as a sideman and as a leader. According to my calculations as a sideman he has recorded on 47 albums, and as a leader he has recorded 19 albums.

Medical

Pat Martino began to have some bouts with depression, headaches and tiredness around 1977. His medical condition was misdiagnosed and he spent some time in a psychiatric ward. In that same year he was given shock treatment. When he began to have seizures he was given a CAT scan where an aneurysm was found. Pat was in California at the time, whereupon his father convinced him to return to Philadelphia where a local neurosurgeon could be found. Dr. Frederick Simeone, Chief of Neurosurgery at Pennsylvania Hospital explained that Pat was born with a group of abnormal blood vessels in the brain. This is where the artery and vein are connected, thereby preventing blood from flowing into the organ. The veins are unable to handle the pressure and eventually would rupture. Pat needed emergency surgery which was performed successfully. The bleeding was located and closed off and the abnormality was found and removed. Upon the completion of the operation Pat was found to have a form of agnosia as he was unable to recognize his family and items in his home, including his guitar. He did recognize his father after a while. Pat once again became very depressed as friends and family would bring up situations that had happened in Pat's past to try and trigger his remembrance of these events. As his memory at this point was severely limited Pat used the computer as a tool to remember things to do, phone numbers etc.

Interview Analysis

Pat Martino despite his medical difficulties remains an extremely bright, insightful, and talented musician who can articulate very complicated theories of music especially those for the guitar. I had read about Pat and the 12-point star which I found fascinating. The first question which was asked of Pat was about this insight. According to Pat, the term 12-point star is symbolic in nature (line 6). He tends to see things in the symbols that are presented around him which are at odds with his commitment to his art (line 12-14). This symbolism is referenced in all cultures as in time and the clock with its 12 numbers, 12 tones in music, the 12 months in the year, the 12 apostles etc. (lines 14-16). Using the clock as an analytical tool Pat sees the subdivisions of time in musical terms. 12:00, 3:00, 6:00, and 9:00 represents the

division of minor thirds in a 12-tone scale (lines 19-22), whereas 12:00, 4:00, and 8:00 are major thirds (line 21). Pat told the story of when he was a young boy eating his lunch, how his mother would consistently remind him of what time it was, where Pat would then see time as his enemy, robbing him of that enjoyable moment in time (line 7-12). Now with this new way of perceiving, the clock no longer was the enemy but the very thing which piqued his interest (line 24-28). An article in Guitar Player (Resnicoff, 1995 May), explains this more thoroughly. The whole is expressed in subdivisions as represented by the minor thirds in the perfect square, the major thirds form the triangle (line 37-39).

Pat was asked about his use of key signatures. His response was that for him simplicity is paramount (lines 51-52). He will take a complex problem and reduce it to its simplest state (lines 52-23). Pat used the example of his recovery from his brain surgery, where he prefers not to remember the moment of crisis in a pessimistic way (lines 54-57), but to use this otherwise negative experience and appreciate it optimistically (lines 58-62). His personal philosophy asks him to remain in the here and now, and that "everything that has taken place I see equivalent to the reason why here and now exists" (lines 60-62). Pat sees key signatures harder to use than memorizing a piece in 12-tone (lines 78-79), saying that he finds it easier to know that a particular note is needed instead of evaluating key signatures (lines 79-80). This non-use of key signatures was a possible outgrowth of his memory difficulties. For Pat, it was easier to remember what is required musically, than to remember the clef or the key (lines 82-84). He will however use key signatures when the situation presents itself or as a renewed interest in the concept of tonality (lines 90-96).

The question was raised concerning Pat's synthesizing various styles in his music. He explained that it is difficult to explain in an evolutionary sense, because it is a seasonal sense (lines 103-104). It appears that for Pat the use of different styles is cyclic in nature, where he may repeat something that had not been done in a long time. He gave the example of the album "Stone Blue" which came out in 1998 but utilized ideas he had been working on in 1976 (lines 110-114). Pat simply remains open to allow the ideas to reemerge when their time arrives (lines 113-115).

I had read in various articles (Resnicoff, 1995 September), (Whitehead, 1988), (Andrews, 1995), and in the documentary "Open Road" (Fallo, 1993), that Pat used computers

as an aid to recovery. He explained that he used the computer to avoid recuperating (line 121-122). As rehabilitation was a painful experience the computer was used as a "place to hide" (line 123), a place where he could doodle and take his mind off the pressures of rehabilitation (lines 123-125). The computer took him through some recovery processes as he became involved in the technology (line 125-128). What began as an escape evolved into something richer and broader (line 130). Pat explained that the recovery process is "boredom to the maximum" (lines 132-133). He was very depressed (line 133), and found that his use of technology assisted in the depression to slowly fade away (lines 134-135). Pat sees a connection with willpower and interest in sparking creative ideas (lines 135-136). This in turn leads to more interest and greater productivity. The more productivity, the greater the recovery (lines 136-138).

Reviewers claim that Pat Martino's style has changed since the trauma. On a National Public Radio show called, "All Things Considered," the host Linda Wertheimer, and a musical reviewer Tom Moon report that "Where he once pursued runaway flurries of notes, Martino became more selective, focusing his attention on smaller, simpler ideas." "His new record is called "All Sides Now," and it shows just how thoroughly Martino has developed this less-frenetic approach" (Wertheimer, 1997). Resnicoff (1995, September) observes while interviewing Pat that (there's a gentility to your new music – the harmonic frame if similar, but you're playing with a more subdued drive." Pat agrees with the stipulation however that if he is more laid back, it is only because "there isn't as much stress with regards to critique as there used to be." (line 145-146).

Pat had used the phrase "colors of the rainbow" to explain his philosophy of life and his personal choice to experience the various styles of music and philosophies. I had asked him whether he saw any correlation between the visual and auditory, between color and music. Pat used an observation that if one were to put the letters of words over a C major scale you could create a motif of sorts for each word. He demonstrated that with the word "beautiful" the motif would be DGCBADABG, where as the word "ugly" would be BDED. These are like compositions in themselves, which were not created from music, but for music (line 170-189). Pat sees that colors can be treated in the same way (line 188).

We talked for a minute about philosophy and his penchant for creating his world moment by moment. Pat looks at the world in pieces. He looks at life analytically questioning what is his function, his responsibility etc. (lines 201-205). I brought up the Harvard Lecture Series that Bernstein gave in 1976 regarding the overtone series and it's relationship to the evolution of music (Bernstein, 1976). Pat regards this as the acceptance of the evolvement in tonality from dissonance to consonance. That the human race began to accept the various harmonic steps music took to increasing complexity. He believes that philosophically it is the individual's decision to allow and to finally accept dissonance, and he finds that once accepted in naturally becomes consonance. Pat used the example of an employee who disagrees with his employer, and then becomes an employer himself. The person grows into the complexity and the responsibility that they had judged critically (lines 263-268). Another example is the parent/child relationship. Pat feels that in the child's eyes, the parent is dissonant (line 269).

After Pat's trauma and during the recovery process Pat had access to old recordings. He did not as some articles claim, seek out these recordings but were simply a part of his environment (line 280-285). He avoided the recordings and avoided the guitar (line 289-290). Pat would often take walks when his father played his old recordings (lines 283-284). It was primarily boredom which caused his interest in the computer, where he would toy with music programs and graphic programs (line 290-293). He found that the computer stimulated his interest, especially the music software. It was then that he picked up the guitar and began to doodle as he was on the computer (lines 293-297). His interest in the guitar picked up at this point which Pat calls "subliminal reemergence" (lines 304-305). The more he played, the "more facility magnified" (line 309). His re-acclamation to the guitar occurred due to the social interactions of musicians and the music business itself (lines 314-317). Pat's new interest in the guitar and music, was like a re-acquaintance with "an old friend" (line 320). He feels that it was this stimulation with music and friends that created the environment to begin the long journey back to music (lines 321-323).

We began to discuss the changes post-trauma in Pat's life. He was not cognizant of any physical changes due to so many other difficulties that were taking place at the same time (lines 336-338). Pat did develop carpal tunnel syndrome which eventually disappeared. He believes it may have been psychosomatic in nature (line 364-366). One of the more serious

physical ailments was that he developed emphysema during this period (line 339-340). Pat had severe bleeding in his nasal arteries which needed to be cauterized often (lines 370-371), the cause of which was and is unknown (line 371). On his way to a symposium in Pittsburgh Pat almost bled to death because of this condition (lines 372-379). He also had a problem with weight (lines 380-381). There were many physical things taking place at the same time during his rehabilitation (lines 381-383). Recently, Pat was returning from Paris and caught pneumonia and almost died, being reduced to 86 pounds (lines 385-387). A friend recommended that he be involved with yoga and certain forms of nutrition (lines 387-390), and has since gained approximately 60 pounds.

After Pat's operations and his re-entrance into the music scene around 1987, he always has the music available on state with him. Since 1998, he has not found it to be that necessary, but still utilizes that as an option (lines 424-427). Pat did not use music stands prior to trauma (line 437), however he had no retainment post-trauma (line 437). As he works at the memorization process it is getting easier and better (lines 438-439).

For Pat to memorize he gives it priority "in terms of what it means to me" (line 444). He gives the same attention to numbers. He immediately will memorize cell phone numbers, bank account, social security, etc. (line 444-447). He gives these items priority status because of their pressing need to be used regularly (line 447-448). He sees a definite correlation between these numbers and music in terms of memorization and recall (lines 448-450). Pat did not consider music a priority for a long time, and therefore needed to have the music written out (lines 450-452).

Pat was asked about his memorization process and his ability to visualize it or hear it. He is a more auditory than visual person (line 455-457). He finds that "melodies are essentially magnetic" (line 461), in that if the melodies have any intrinsic value they will remain in your memory (lines 461-462).

I asked Pat about the concept of confidence in terms of life in general, and in his approach to music. He explained that there are different meanings to the word practice. The first is in preparation or the equivalent of a student, the second is the equivalent of an attorney or a physician depending on the use of the word (lines 474-479). When Pat is preparing for a performance, he develops his "chops" and becomes more comfortable with the security that

the "chops" exist (lines 479-482). But when he is on stage or in rehearsal there were no "chops" because when playing privately there is no interactive pressure (lines 482-486). He finds that practicing does not always prepare oneself for a live performance (line 487-488). He made the analogy to the computer and some music sequencing programs that conceptualize a division of step time or real time. Step time is the preparation for an event and real time was the event (lines 489-490). There comes about a time when the step time and real time overlap which can occur when there is a feeling, a worry before a live performance which is normal (lines 493-494). He came to the conclusion that worry is devastating in terms of sabotaging yourself and your endeavor (lines 495-497). Now Pat does not let that anxiety bother him. It forces him to do the very best he can under all circumstances, which provides the energy which fuels a technique that is precise (line 499-501).

The concept of a kinesthetic memory, or muscle memory was discussed. Pat does not think in those terms, because for him, jazz is improvisational and spontaneous (line 514). He does notice however, certain themes stemming from improvisation which are memorable due to their physical positions and that "feel right" (lines 515-519). Prior to a performance it is these kinesthetic ideas which are retained more that anything else (line 518-519). When Pat works as a side man or featured artist he always asks the leader of the project to send the scores so that he can familiarize himself with the music before hand (lines 537-540). I gave the example of another subject JJ who would learn tunes in all 12 keys prior to a gig. Pat responded that the only time he did something similar was working with Sonny Stitt, when Sonny would call a tune each night in a different key (line 547-552).

Basic Information and Background

SC is a right-handed female Caucasian who is primarily a pianist and who began her formal instruction at age seven. She listed guitar, flute, voice, percussion, clarinet, saxophone, recorder and trombone as examples of other instruments she considers herself proficient on. She has taught privately for many years mostly before her trauma of 1991. Formally she has a baccalaureate from Westminster Choir College where she majored in church/liturgical music, and she has received a masters degree from C.W. Post College. Beyond this she has 40 additional credits (line 97-99). SC considers herself an avid learner (line 103) and has some training in Orff and in specialized training on the recorder. She has also been involved in international folk dance (line 109-111). SC writes plays, is active in playing the piano, singing and actively seeks projects that would stimulate her intellectually (line 113-115). She taught privately for some time and then became involved in a public school program (line 107-108).

Medical

SC is a very interesting case in that she has suffered two separate brain traumas. The first occurred in 1969 when she was 13 and was struck by a car. The second occurred in 1991 when she was subject to excessive amounts of carbon monoxide. It should be noted that medical records for SC were unavailable. Family members were contacted for assistance as was the case worker who resides with SC. All those with whom were spoken with avidly searched for a name of a neurologist or some other name for which I could contact but to no avail. The first trauma occurred so long ago that records could not be located. As to the second trauma, both SC's brother and husband were spoken with. The brother explained that the more recent trauma effected the family so intensely that once SC was recovering and being successfully rehabilitated he made the decision to destroy the medical documents. Because of this lack of information, SC's husband was interviewed and was able to shed some light on the matter. With regards to the first trauma, SC was struck by a car while walking with a friend. While she did receive a head injury she does not recall the area of the brain that was struck. As a result of the injury she began to have petit mal seizures for which she was medicated. SC took this medication until she was 18. The husband remembered that the lobe affected by the

trauma was either temporal or parietal. He remembers that while her overall memory tended not to be poor, he did notice some very mild memory lapses prior to 1991.

The trauma of 1991 as stated above was due to excessive carbon monoxide poisoning for which she suffered brain injury. During the course of her marriage she desired to become pregnant, but her doctors were concerned that a pregnancy may be the cause of seizures (line 13-14). She was therefore put on medication to prevent possible seizures in case of pregnancy. This medication caused SC to go into a depression (line 16-17). She cites this depressed state as the primary reason for the carbon monoxide poisoning. SC was in rehabilitation for two years after this episode (line 17-18). After this second trauma the husband JC remembers that SC initially had a paralysis on her left side primarily affecting the arm and leg. This paralysis lasted for two days while an overall weakness has lasted even until this writing. JC commented that the weakness is exhibited by a muscle spasm known as clonus.

Interview Analysis

SC as noted above suffered two separate traumas. The first is described in the previous paragraph. SC spoke about her impression of her high school years where her memory was partially impaired and that people felt that she was a "spacey chick" (line 21). Fortunately SC was very bright and talented in the arts and in math and was able despite some memory difficulties to achieve good grades (line 23-25). Her main problems seemed to occur in the area of reading comprehension (line 24-25). This is due to the fact that in understanding what you have read requires the ability to remember concepts and ideas previously learned. This ability was somewhat impaired in SC.

SC did not notice any auditory difficulties after her trauma and did not feel that her long-term memory was impaired in that she remembered people, places, and things from her past (line 40-41). She recalls an incident when she was hospitalized after the second trauma where she had been watching the movie "Amadeus" and was able to identify characters accurately (line 42-44). SC also remembers musical pieces learned prior to trauma and can still play them accurately (line 44-45). She feels that this musical aspect of her trauma remained unchanged (line 47-53). After the second trauma she lived with her parents which was located near the office of rehabilitation. Her quality of life improved due to the proximity

to the place of rehabilitation, the utilization of a gym in the area, and the fact that the parents owned a piano (line 57-60). SC was most cognizant of the fact that when a person is head-injured it is imperative to re-experience developmental strategies. To crawl, swim and find other sensory activities that will enhance the rehabilitative process was an important part of this process (line 60-64). She felt that physical exercise would also be an important factor in this process. SC utilized a large local gym where she would exercise and be challenged intellectually as well as physically. It was a rather large facility and SC would often get lost in its complicated layout due to her impairment in her sense of direction (line 65-69).

There were no visual difficulties noted after the trauma (line 71-73). SC did experience short-term memory difficulties and reasoning skill difficulties (line 77-79). Immediately after the trauma her cognitive skills were very concrete not being able to see or understand subtleties. Things were felt to be black and white. This experience was for everyday activities and not musical activities (line 80-82). SC does not remember which side of the brain was affected by the first trauma. She does know that she was hit on her left side and upon impact was thrown into the air. During the second trauma the whole brain was affected due to the lack of oxygen (line 84-92).

SC is very cognizant of her handicap and strives actively to utilize compensatory skills, though she acknowledges that this strategy is no always successful (line 123-124). Interestingly enough SC has studied with Dr. Ana-Maria De Bottazzi who is another subject involved in this thesis. Dr. Bottazzi is a renowned pianist who has worked with SC and who also suffered a traumatic brain injury. She has assisted SC in techniques involving these compensatory strategies. SC uses motor memory in this manner as well as using rhythm to assist the motor memory. She feels that you can then play without formally processing everything (line 131-136). SC states that when you use this motor memory, "your hands just do it. Your whole body just does it." SC enjoys the analytic process involved in the learning of a piece of musical literature. She considers her approach scholarly in nature (line 140-143). She was questioned as to how this may occur. SC explained that in sonata form it is pretty clear what is going on (line 151), but as the piece develops it gets more difficult (line 152). The example was given that in the memorization of ballades and etudes by Chopin for instance, she was aware of the harmonic structure but utilized her motor memory in addition

(line 152-155). SC does possess absolute pitch (line 157). Although she has this capability it does not appear as if she utilizes it to its potential (line 163-169). She instead prefers a visual type of memory which she labels topography (line 173-174). It appears that this is a function of a motor memory in that she is sensing with her fingers the feel of a particular passage (line 178-187). The question was brought up regarding other interviews where a person could visualize the music as they are conducting or playing, SC does not approach it in this manner (line 193-196).

Regarding the elements of music and it usefulness in the memorization process, SC responded that she thinks in the key first, and then the meter (line 201). The elements of articulation and dynamics would be regarded automatically in some works, but not in others. SC gave the example of Bach where certain pieces might be thought of and memorized automatically (line 206-209). She uses a strategy employed by Dr. Bottazzi where you do not concentrate on a particular way of memorizing, but do things the opposite way from the norm. This will afford a way to look at the piece in varied ways (line 209-212). An example was given that if some particular passage was written legato, then you would practice it staccato (line 212-214). SC also uses this with rhythms of a piece. A passage can be played with different rhythmic patterns. This will let the piece really sink in (line 216-225).

SC taught privately at age 18 (line 245). It appears she had younger students before the first trauma, but she herself was only a child (line 244-245). Upon her graduation from college she taught a great deal and lead choirs in churches (line 245-246). After her marriage, she was introduced to public school teachers who encouraged her to get a degree in this field (line 247-249). SC feels that she did well as a private teacher and gave the example of one of her students attending an adjudicated festival and who had done very well (line 254-256).

In the past SC felt comfortable about memorization although nervousness was always present. She feels that this was most likely due to her previous head injury making her self conscious (line 261-262). SC recalls a time in high school when during a performance with the school choir she suffered a seizure. She was able to finish the piece because of her ability to improvise (line 264-266). Now SC prefers to perform only with music in front of her and considers herself more of an ensemble player than a soloist (line 267-269).

SC acknowledged a difference in the way she memorizes now as compared to the way in which she memorized when she was younger. In her early days she would be able to memorize a piece of music without consciously attempting it. Currently she spends a good deal of time on the analysis of a piece she wishes to memorize. SC will look at the harmonic structure, phrasing or touch to give her something to relate the memorization process to (line 276-280). As to the question of where she would go back to should she be distracted during the memory process, SC felt it would depend on the piece she was working on and its complexity (line 282-285).

When asked about the amount of pieces she could play informally at present. Due to her memory difficulties she does not feel that many would be able to be performed well without music. With the music as an aid, she appeared confident in her ability to play the pieces from her past (line 291-299). She added that a piece without a lot of technique she might be able to remember and perform.

SC can play in different styles of music. She mentioned playing gospel, rock and roll, jazz, and classical. The process of memorizing these different styles would depend on the complexity. A simpler piece, she noted would not be a problem to memorize. Especially the pieces with simple chordal structures. She does not feel that she would be successful with a piece which called for exactness as in a piece from the standard classical piano literature (line 311-317).

Confidence for SC diminished a great deal after the head injury, although she admits to not possessing a great deal of confidence even prior to the trauma. She did study privately for a time with different instructors, but it was not until her mid-20's where she met the aforementioned Dr. Bottazzi (line 322-326). Dr. Bottazzi was of great assistance in giving SC necessary skills to apply to her ability to perform. SC mentions that if she had only known about these insights when she was younger she might have possessed a great deal more confidence (line 325-328). SC reiterated her problems with memory from the time of her trauma at 13, and the fact that she was not always told that memory problems would have been a natural symptom of her trauma (line 329-332). She remembered that teachers for instance did not comment on her difficulty, most likely because SC managed to keep her grades high, and used her innate creativity as a tool of compensation (line 332-334). She offered the

example during the taking of a state exam where the question was asked to write about a book she recently had read. Due to her memory difficulties she could not remember anything she had recently read. After an initial panic, she tapped her memory and wrote something about the Bible which was read long before the problem of memory (line 335-339). SC talked about how she would compare herself to her friends who were getting high scores on exams and who were accepted into well known universities. She felt that due to her memory problems she would not be able to compete with these high scores (line 351-355). SC felt that she lost a great deal of self-esteem and compared herself to Dr. Bottazzi (whose interview and analysis can be found in this document) who possesses an indomitable spirit and who has learned to aggressively fight whatever misfortunes may occur (line 355-358).

SC enjoyed playing Beethoven, Bach, Brahms, and Chopin when she was younger and admits to not being fond of Mozart. Her favorites to play now include Scriabin, but have not changed dramatically since the trauma. SC also enjoys Debussy and Ravel, and has played the Gershwin preludes (line 394-406). SC was asked which pieces she could play for me, if music were available. She mentioned the first two movements of Beethoven's "Sonata Quasi Una Fantasia," Mozart sonatas from the Heiden, Chopin Waltzes and Mazurkas, Debussy Preludes, some Brahms and Satie's "Pavanne for a Dead Princess" (line 412-426).

6 Conclusions

When examining brain trauma, there needs to be clinical and empirical evidence presented so that fact can build upon fact and an understanding of the complexity that occurs in trauma can be examined and understood. This is done so as to help a patient in their suffering and add insights and strategies for further studies. Most of the literature that was read to prepare this thesis were clinical studies which offered observations made by others concerning a patient without any questioning of the subjects themselves (Serafine, 1981), (Hood, 1977), (Liegeois-Chauvel et al., 1998), Of course the case can be made that it is the patient being studied, the researchers do not require any offer of insight on their part. The assumption thereby is that the patient themselves cannot offer anything of value to the understanding of the matter. This does make sense and should be the case for clinical studies of a quantitative design. However, are there insights that the subjects themselves can offer that will compliment the literature in a qualitative study? In (Kinsler and Carpenter, 1995) for instance a study was designed to measure eye movements in the reading of music and the playing of particular rhythms. It may have added some additional insights if the researchers asked pointed questions of the subjects regarding the "how" and "why." For instance, perhaps some of the rhythms were easier to read because of a particular familiarity with that rhythm. Perhaps the musician was very familiar with a piece that used that rhythm which coloured the way they approached its reading. In a purely clinical study, these insights do not appear important in that they are testing a small piece of a much bigger puzzle. In another example, (Gagoon and Peretz, 2000) it was found that when listening to music the left hemisphere of the brain leans more towards positive emotions, while the right hemisphere leans towards negative emotions. While this article was most interesting I found myself asking, "Were the emotions felt related to music that the listener grew up with?" "Why did a particular melody create that emotion in a person in the first place?" "Did any one piece strike the hearers differently? In other words, did two people hear the same piece and offer different emotional responses, and why?"

Upon commencing my initial studies, thousands of important and insightful writings were discovered on the topic of Neuromusicology. These were found in my readings, from information gathered at conferences and meetings and from medical as well as

neuropsychological professionals. It became apparent however, that while there were ample clinical studies in the field of Neuromusicology, a lack of qualitative studies also presented itself. A handful of articles that somewhat address this design were found, (Seibert et al., 2000 March) but these were however few and far between, and once again offered little input on the part of the subjects themselves. There were interesting readings as in a book by Sudnow (2001) in which he gives a stirring account of learning to play jazz piano, but in the diverse disciplines of clinical research, an important part of understanding where or how a patient may be experiencing difficulty, may come from the patients themselves. A great deal of valuable knowledge may shed light and compliment the more objective clinical observations. People generally have some valid opinions regarding their own awareness of the world around them and this information can colour the findings of a study. There appeared then, in the field of Neuromusicology, to be a rather large gap in the literature with this in mind. The conclusion was drawn by me to approach the apparent gap in the literature by first allowing the clinical evidence to speak for itself. This then would be complimented by creating a qualitative body of information by a series of semi-structured interviews with 'normal' and brain damaged musicians. These subjects could offer insights and clarifications to the already existing body of literature.

The decision was made to add to the literature, not by providing more clinical experiments on a specific topic, but to offer a musician's views in a manner that reflected their own understanding, and to permit them a voice. It often appears that the human side of research is lost in a clinical setting, yet this is a valuable side of the issue. People often possess a clear understanding of what is occurring around them albeit in a subjective way. The approach then, was to find six musicians who have experienced brain trauma and to compare their use of their musical memory to their counterpart; six musicians who have not experienced brain trauma. Each interview would be examined and compared with the others with particular regard to the differences and similarities between the musicians who have suffered brain trauma and those who have not, all within the backdrop of the clinical evidence. In this thesis then you will find both the clinical findings as well as the personal reflections of the subjects themselves.

My conclusions sought regarding the study were concerned primarily with musical memory and how it was used in remembering music of the subject's past, as well as strategies involved in memorizing new music post trauma. Part of the conclusions drawn from the analyses between the 'normal' and brain damaged group of musicians was that there were more similarities than not between the two groups. Those with brain trauma and those without brain trauma approached musical memory in much the same way. Strategies were similar in that each individual utilized their strengths primarily, whether that was visual memory, auditory memory or any other modality. A difference found between the two groups manifested itself in the sense that the brain damaged population utilized a more multi-sensory approach, whereas the 'normal' population felt more secure with their primary mode of memorization. The 'normal' musicians were confident in whatever approach they normally would utilize. Most relied on their visual sense, though some benefited from their auditory or kinesthetic senses. A typical scenario would be as follow: the musician would read a particular piece of music and begin their strategies for memorization usually by reading and practicing a certain number of measures over and over, and then begin testing themselves to ascertain how far they have come along. The brain damaged population would begin the same way, yet possessing the insight that because of their trauma, they would need another strategy as a backup and reinforcement. For instance, Ana-Maria possesses a strong visual memory, yet she has had that system fail her in concert settings when her mind would simply go blank. She therefore would also rely on her kinesthetic memory or auditory memory should the initial approach fail her at a critical time. This system of study is different then other musicians like BM who utilized kinesthetic memory also in addition to his visual memory. The difference is that BM is using kinesthetic memory as an additional or secondary strategy whereas someone like Ana-Maria would actually spend many hours in addition to visual memory, only working on her kinesthetic memory. In this manner, should her visual memory fail, her kinesthetic memory would have almost the same amount of practice time as the visual. SC explained how she felt that she could no longer trust any memorization strategy after her trauma as she realized that they might fail her at a critical juncture. Her way to attempt memorization as of late, is to follow the example of Ana-Maria and learn the piece using every possible memory

system. This still does not make her comfortable enough to perform in public from memory however.

In terms of rehabilitation, there have been many medical advances in recent years that offer hope to those who have experienced traumatic brain injury. I have attended conferences, which discussed new and varied techniques that can assist neuropsychologists, musical therapists, and other medical professionals to understand and approach the rehabilitation of patients in more diverse ways. Although not clinically proven in a sufficient manner as yet, the Tomatis Method may offer some insights and strategies that can also assist in this process. There are many who disagree with the method, and yet the same people will also agree that not enough clinical evidence has been presented to date. In light of the fact that many people have benefited from the method and the suppositions appear valid, it is my hope that medical professionals will take the time to review the many Tomatis writings and develop studies to clinically test its validity.

7 Appendices
Appendix-A Pilot Study Interviews
Interview with BM

PP: Ok. Today is October 2, 1999. I'm talking with BM.

BM: Oh, so I will try to speak slowly now that I know you have to transcribe this.

PP: Thank you. Billy, tell me about how you memorize a piece of music. What steps do you take, or processes do you use?

BM: Oh, well. Generally, I only memorize classical music. Are you interested in that?

PP: That's fine. Oh, sure.

BM: Actually, I have a real method for that. A long time ago I used to just play a piece until I had it memorized. But I think some time in college I started breaking it down to where I literally memorize a piece measure by measure, depending on the complexity of the piece. If it's a Mozart sonata, I may memorize a four-bar phrase at a time. If it's, say, a Schoenberg piece, I may memorize by each measure and just work on one measure until it's in my memory, and then go on to the next measure, and methodically work my way through a piece. I've found that it works very quickly for me. I can memorize a sonata in a matter or two or three days.

PP: Wow.

BM: And have it there for ... pretty much permanently.

PP: That's really good. When you memorize, let's say, the Mozart sonata, and you do it phrase by phrase ... you do both hands?

BM: Yeah. Again, it depends on the complexity of the piece. But for the average ... Mozart, Chopin or something like that ... yeah, I would work both hands.

PP: Ok. Now, when you memorize it, do you think in terms of the feel ... the kinesthetic? Do you do it by melody? Do you do it harmonically? What's your ...

BM: I think it's a combination of the physical memorization in the fingers and ears. I've often thought ... I don't relate to music at all visually. I don't ... I read that Rubinstein would look at a piece of music and it would be in his head, and he would literally sight-read from his brain. But I have no visual connection to music at all.

PP: Ok. So you use ...

BM: Which I think also is kind of limiting when it comes to conducting scores. I, you know ... I think if you had a semi-photographic memory and you could actually visualize a score in front of you, that it would be helpful. But I don't visualize music at all.

PP: Ok. Do you hear something before you play it? So when you say you're using your auditory memory, let's say, in memorizing this Mozart sonata ... As you're about to play the opening bars, are you hearing it?

BM: I hear simultaneously, I think. I don't hear before I play. That would be too confusing to me. But I definitely rely on my ears. No matter how complex the piece is, if I play a wrong note I can hear it. I mean, I don't play Schoenberg and modern music that much anymore. Well, actually I do because I compose and some of my stuff is pretty modern. And I can play a tone cluster and no matter how many notes are in it, if one note is off, I know that it's wrong. So I definitely hear simultaneously.

PP: Ok. By cluster, you mean ...

BM: Like say, I played a chord in the right hand that had seven notes in it ... let's say, playing two notes with my thumb, or something like that. And I write like that. I write a lot of clusters. If one of the notes is off, it just sounds wrong.

PP: Ok. So you're mainly an auditory person, rather than a visual one.

BM: Yeah, auditory and physical memory. Because if you're playing real fast, a lot of times you don't have time to really think that much about what you have to do. It has to be a physical memorization. If you're playing a Chopin etude or something that's going a mile a minute ...

PP: Now, do you mean ... When you say your physical, do you mean the actual motor movement or the way the fingers feel on the keys?

BM: I think we all have motor memory in anything that we do. For example ... Well, anything, like riding a bike is a matter of memory. Working a clutch on a car ... if you drive a stick shift. There are a lot of things ... typing, of course. There's definitely motor memory at work in so many things that we do with our hands.

PP: Um, part of the problem I think a lot of people have who are learning an instrument might be that maybe they haven't gotten to that stage. Do you think that might be true?

BM: Well, I think it takes a certain amount of patience. I was always so impressed ... I studied in France for a year, and I found out that their word for "rehearsal" ... the French word for "rehearsal" is "repeticion" ... repetition. And that I think is ... more than anything else, a matter of motor memory. You just do something until you get used to the feeling of doing it. Shooting baskets, you know, hitting baseball, whatever. I think it's all a matter of motor memory.

PP: Right. Um, let's get back to ... Before we turned the tape on, we talked about the difficulty a lot of people have memorizing words or lyrics. And you had mentioned that you were on stage ... that you were a stage performer also. As an actor ...

BM: I've done a couple of acting roles. And being in the theater, I never realized that specific talent that actors have until I actually tried to do it, and realized that memorizing words is a feat. It's not always that easy.

PP: Would you consider that like a special talent, or a gift, that someone might have. As you might have it for music, they would have it for memorizing words.

BM: Absolutely.

PP: In the parts that you've played, was it a dramatic, or was it musical theater ... did you have to sing?

BM: Music theater.

PP: Music theater. And did you ever have to sing on stage?

BM: I've never sung on stage.

PP: Ok. But when memorizing lyrics, do you find the same hesitation as you find in memorizing the words to a show?

BM: Yes, I didn't realize until I actually took on an acting role, that memorizing lyrics is just not something I do. A lot of conductors memorize all the lyrics and sing the lyrics while they're conducting. I don't because I don't remember what they are. And oddly enough, my wife makes fun of me because I always mess up words to songs I happen

to be singing around the house. But oddly enough, I remember lyrics to songs that were written ... that I used to listen to up until the time I was about 20 years old. From 20 years old, it's a mess.

PP: So, post-20s.

BM: Yeah. Fifties songs ... that I listened to in the Fifties, or early Sixties, I can remember all the lyrics. It's very strange. But I just want to tell you that when I was in my 20s ... when I was a college student ... I also sang in choirs. And I noticed that when I was reading ... even reading the music ... And also when I rehearsed companies ... I can read music, you know ... I have a tremendous facility for reading music, but I can't read the words. Even looking at the lyrics, I mess the lyrics up all the time. There seems to be a short. And I always tell my companies when I'm rehearsing, and I sing a wrong lyric as a demonstration ... not to listen to the words that I sing, because more often they'll be wrong. Even looking at lyrics, I don't actually see them that well.

PP: You mentioned in college that you were in choirs. Did you sing in different languages?

BM: Well, a little bit. I almost forgot about that, because I was in glee club. Yeah, I've done that a little. And also in working with singers, I've worked in languages a bit. I studied in France, so I know French, even though I'm not fluent. I know it. And in touring in Europe, I've sort of looked at ... studied a little bit ... various languages, like basically Italian and German. So I know pronunciation, even though I'm not that familiar with the languages themselves.

PP: Ok. Do you find that you have the same problem remembering lyrics in other languages as you do in English?

BM: I've never tried to learn lyrics in other languages. I haven't even made the effort.

PP: I was just curious. The thought just came to me.

BM: Yeah.

PP: Let's say you just memorized the Mozart sonata, what criteria do you employ to try to ascertain whether you were successful at your memorization?

BM: Oh. Really, I'm never totally successful. It just reminds me of something Rubinstein said. Which ... you know ... he was one of my favorite pianists ... just an amazing musical man and sort of an idol. And speaking of performances, he stated that he's never done a piece right. He's never done a perfect performance of anything. And I've never done a perfect performance of anything. I've never memorized something cold ... to the point where I have never made a mistake. So it's always an ongoing process.

PP: Ok. So what kind of mistakes would you be referring to? Like, where do you find the shortcomings?

BM: Oh, the typical mistakes ... wrong notes, memory lapses, getting lost, whatever ... making up ...

PP: That would be what I would do ... start to make up harmonies for Mozart. I know.

BM: I guess what I'm trying to say is the memorization process is an open-ended process. There's never a conclusion. There's never a point at which you can say, okay, I've memorized this ... my work is finished. The work is never finished.

PP: Ok. Um. I guess to reword what you just said just so I understand ... You're very critical, obviously, of yourself, because you want it to be perfect. So you feel like you've never really performed anything perfectly by memory because there's always ...

BM: I've never performed anything perfectly by memory or otherwise.

PP: Have you ever ...

BM: I've always thought ... first of all, music is an art. And I've always thought of art as a pursuit. It's a pursuit of perfection, but it's also like chasing a rainbow. You never arrive.

PP: Ok. So you're more interested in the journey than in the destination.

BM: Yeah, absolutely.

PP: When you're memorizing a piece of music and you get distracted, tell me what you do to try to get back on track again. Are there different procedures you go through, or is it just ...

BM: Distracted?

PP: You're in the middle of memorizing a piece ... the Mozart sonata ... and your wife says, honey, take out the garbage.

BM: My wife would never say that. Ha. Ha. Ha. She's upstairs.

PP: Oh, is she? We'll play this back for her.

BM: She's probably listening. Ah, no, I don't have distractions. I just stop working and then take up where, you know ... If I get a phone call or what, I just stop and then go back to it. If I put my mind to memorizing, it happens very quickly, and it's very much a method. It's simply a matter of sitting down and taking the time to do it.

PP: Do you have to start over, or can you start where you left off?

BM: I'll start over. Actually, part of the method is to work the piece from beginning to end. Like I said, I'll learn a piece measure by measure, phrase by phrase, until I get to the end of the piece. And then I'll start over and do it again. So ... each time I do it, it gets better and better. And of course ... like I said before ... it never gets perfect. But the actual raw work of the initial memorization is a process that's done very quickly for me ... in a matter of hours or days. I guess a footnote to that would be ... unfortunately, I'm not the kind of musician that once having memorized a piece, it's there permanently. I have to practice. If I stop playing, it fades. It goes away. Each time I re-memorize a piece, like after two or three years, or five or six years, or 10 or 15 years ... each time it comes a little bit quicker. But it's a process that I have to repeat. I have to maintain the level of memorization. It doesn't maintain itself. It's not there permanently.

PP: Ok. If you were going to memorize a Mozart sonata ... we get back to that again ... You've never played it before, but you were asked to perform it someplace.

BM: Oh, I've played them all [joking].

PP: Did you?

BM: No. I wish.

PP: I was going to be in awe there for a minute.

BM: Baron Boyan, I'm not.

PP: Let's say it was a fairly difficult sonata, and you were asked to perform it September 1st someplace ... A low key kind of event. How soon would you definitely get started on that?

BM: Well, now, that's a different kind of question. Performing is like totally different because I can memorize a piece quickly, but to actually put it in a performing situation, to me that goes beyond memorization. That is where you have to ... That's where practice comes in.

PP: Ok.

BM: You have to practice. You have to ... Again, getting back to the French word ... You have to repeat it. You have to know it so cold. I mean you have to practice it until you and your family and all the neighbors are totally sick of it ... Before you can dare put it in front ... For me, before I can dare put it in a performing situation, because there are so many mental stresses involved in performing that ... So many things can go wrong.

PP: Mental stress ... You mean ...

BM: The mental stress can cause you to have all sorts of memory lapses. So that's where the motor movement becomes very, very important. Because you have to be able to perform the piece ... Be able to play the piece ... When your mind has gone completely berserk due to the adrenaline rush and the nervousness, and so forth and so on.

PP: So you see a definite difference between memorizing for your own enjoyment and memorize to actually perform it?

BM: Yeah.

PP: Just so I understand, tell me about the differences between the two.

BM: Well, leaving Mozart and let's move on to Beethoven.

PP: Sure.

BM: I could memorize the Beethoven Sonata in a week or less ... unless it's a [can't understand what he said here.] ... but I don't think I would be prepared to perform it for at least a year ... constant rehearsal, practice, perfection, going over and over every day. I would have to know the piece so well that I could almost play it backwards, and then maybe I could put it in front of an audience.

PP: I think I might have asked this, but this is just for my own clarification. Do you think harmonically at all?

BM: I think intuitively, probably, I think harmonically. I hear chords and melodies ... Actually this is not a question that you've asked me, but I think it's probably important as far as how I think musically and how I perform musically. The question of perfect pitch often comes up, and I generally hate to be asked that question because I've never been sure how to answer it ... because on one level I do believe that I have perfect pitch in that I hear pitches ... I automatically know what they are ... I hear them in my head. But it's not perfect.

PP: Ok.

BM: I am more sensitive to some instruments than others. If I hear anything that's on a piano, I can tell you with almost no effort at all what key it's in ... on what key it's being played. But if someone were to sing a note to me, I could easily be a half-pitch off one way or the other. And I think it's because as a pianist, all pianos that you play are slightly different pitches, so I think for that reason I've never developed perfect, perfect pitch, as, say, perhaps a violinist might, who always tunes his or her own

instrument and really gets a very real feeling of what A440 is. To me, A440 could be A440 or A480 or A420, or something like that. But as far as music goes, and the way I approach it ... not even the way I approach music ... essentially the way I hear music, I'm very pitch oriented, and that has a lot to do with the way my memory functions ... with the way I perform.

PP: Ok. The last gentleman I interviewed had both perfect pitch and photographic memory.

BM: He sounds like a terrific musician. Was he?

PP: Yeah, he is.

BM: That would be a great combination.

PP: He talked about seeing the score in his mind and actually he was more aural also, so he could hear everything before it happened. That's why I asked you that question initially. He was telling me ... Tell me if you can do this ... that if someone just played a cluster, he could tell you each pitch.

BM: Yeah, basically. In fact, we were talking about my Juilliard audition. They did just that but they still wanted me ... [can't understand last words]

PP: Ah, it's so frustrating.

BM: He sounds like he would make a wonderful conductor.

PP: He conducts choirs right now. Five years ago, he got a job teaching in a school. He does a lot of church music. He writes quite a bit. But I had to adapt my whole questionnaire differently.

BM: I think I would probably be someone like Baron Boyan, who has a terrific memory and ... do all that stuff.

PP: Yeah. I've always wanted that ... to be able to see something and remember it. As a conductor, I still rely on music when I conduct. Sometimes it gets in my way. In my other interviews, when I asked people how they memorize, they gave me a list of the elements of music in terms of the way they approach it in terms of memorization. Can you give me an idea of the way you would approach it?

BM: No, actually, what I do is very pedestrian, and it's a very painful process ... I mean it's really rough work, but it's so fast. I originally fell into that because a fellow student when I was in college once bragged about how she memorized a Chopin etude ... the E major ... in 15 minutes. I said, wow, that's really impressive. So I said, let me see if I can do something like that. And that's how I developed that whole process. It's very, very mechanical. I don't analyze music ... which is probably what you're asking ... if there's analyzation process, you know, figuring out the harmonies, the tone, the chordal progressions, the sections of the music, form and analysis ... all that stuff. No, I just sort of take that for granted, and I just sort of absorb that because all that stuff is very important to me because I write music as well, and you have to be able to think analytically in order to compose ... to make any sense, you know, to yourself, if not to other people. So, that's part of my musical approach, but it really has nothing to do with memorizing.

PP: Ok. Let me ask you a similar question in a different way. One person I interviewed said that she memorized the notes first, then she worried about articulations, then she ... Like she did it in ...

BM: In sections.

PP: In sections, but not ... Besides doing the typical phrases of a piece, she also took out elements. Like she didn't worry about dynamics right off. She didn't worry about the articulations right off. Whereas other people said, no, no, if I memorize an eight-bar phrase, I memorize everything about that eight-bar phrase.

BM: I think I probably would go in sections. I think I tend to go for the notes first and ...

PP: Oh, you do it that way too?

BM: Well, yeah, I think ... I'm a little bit not too detailed as I memorize, and the more I learn the piece, the more I think, well, maybe I should pay a little more attention to what the composer wanted.

PP: Ok. So if you had to think of an order, then, of what you would do in terms of the process of memorization, would you put notes ... Where would notes be in that, first?

BM: Yeah. The notes and the feeling. And I think I would pick up a lot of the articulation and dynamics and stuff as I do it. But that wouldn't be my focus.

PP: I don't want to put you on the spot, but how many pieces do you think you can perform fairly successfully from memory right now?

BM: None. [laughing]

PP: Are you being too critical of yourself?

BM: No, I don't practice enough. And besides, there are levels of success.

PP: Ok. Let's take the lowest level.

BM: Ask me how many pieces I've successfully performed in my life, I might tell you none. [laughing]

PP: It's interesting the different answers you get from different people.

BM: Again, it's the pursuit of perfection or the pursuit of whatever. I was on tour like a few years ago, and we stopped ... we were doing one-nighters and we stopped at this one university that had a whole basement full of grand pianos. And, God, I was in my world, you know. We only had one show that night, and I think I sat down for my own amusement and played for about 3-1/2 hours from my repertoire without ever repeating myself once. And being relaxed and comfortable, I was playing pretty well. None of those pieces could I have played in an actual performance because it just wasn't practiced enough. But just to sit down and play ...

PP: How many pieces?

BM: I could play for hours and hours.

PP: How many pieces did that encompass ... 3-1/2 hours that you did that?

BM: I don't know. I had ... at any given ... I just don't ... I really don't know. I've never really thought about it. I can play three or four Beethoven sonatas, maybe a couple of Mozart sonatas ... I always try to play every now and then a concerto that I've written. And I just love to play Bach ... got about two or three suites that I like to play. There's a lot of stuff in there ... none of it perfect because you really should practice every day, and I don't. I don't do that anymore.

PP: Have you ever had to memorize a style different than classical? I know you've talked about the different genres within classical, like a more modern style rather than ... as compared to Bach, but ...

BM: I don't think I've had to memorize other music outside of classical. I ... on my own ... have memorized shows that I've performed ... just if I get in cases where I feel like I'm bored with having to turn pages, I'll just memorize the show so I can do other things. [laughing] ...

PP: You mean while you're conducting? As a conductor or as a pit musician?

BM: Both. I don't know about you, but I've had a couple of shows that followed me all my life. And I guess the big show for me is Ain't Misbehavin', which is a piano show from beginning to end. I memorized that very early on. Actually, I memorized it before I even performed it for the first time to be doubly cautious. So, I occasionally memorize shows ... not because I have to, but for other reasons ... for whatever reasons I decide.

PP: Let me ask you a question. That's an interesting thing. What would happen if, let's say you memorized Ain't Misbehavin' and you went and did the show, and I'm sure you've encountered this, a choreographer comes up to you and says, oh, I need another 32 measures of music for my section of dance. Would that bother you ... in terms of memory? I know it wouldn't bother you in terms of ... you just put the repeat signs ... whatever. But let's say you had it memorized. Is that a problem for you?

BM: You know, I don't think that's truly come up too much because usually if I'm doing a show, they've always been shows that someone else wrote. So I would just snatch some music from somewhere and do an instant arrangement. So, no, that wouldn't be a problem.

PP: It wouldn't throw a damper on your day or anything?

BM: No. And also, you know, I play jazz, so improvising is no big deal to me.

PP: Ok. That's what I wanted to talk about. See, I didn't know if you also played jazz. When you accompany singers and stuff, do you do transpositions? Can you do that on sight?

BM: Oh, yeah.

PP: Do you find you rely on ... Can you transpose ... use some chord symbols ... Let's start with that. Would you approach it that way?

BM: Sometimes I use whatever I can. [laughing]

PP: ... to get the job done.

BM: Yeah. Sometimes it takes everything. No, but that's an interesting question because I thought ... I've always thought that music is a wonderful thing. It's so varied ... within music itself there are so many skills ... so many things that you can be called upon to do. And I've found throughout my career that as you use one skill, you have to constantly utilize skills or they diminish in quality. So that if you're in a situation where you have to do a lot of sight reading, your sight reading improves, but at the same time your ability to perform pieces by memory ... because you have not been practicing that much ... that diminishes. If you find yourself in a situation where you have to do a lot of instant transposing ... The more you do it, the better you get at it. If you go into a situation where you're away from that for a while, you start to lose that skill as well. It's like ... the memory is like your muscles. It's like another muscle. It's a use it or lose it situation.

PP: Good. Have you ever had to memorize a jazz piece?

BM: Um, that's sort of like contradictory ... memorizing a jazz piece.

PP: Why?

BM: Because jazz basically implies improvisation.

PP: Yeah. But you usually play the head first and then ...

BM: ... then you make some stuff up ...

PP: But in terms of playing the head ... What if you're doing, I mean, Satin Doll, and playing with a saxophone ... Can you do it ... instead of D minor being the first chord, you might need it in F sharp minor.

BM: Oh, that's more like transposing.

PP: Right.

BM: Ah, that can be a problem. You get used to playing your favorite pieces in a certain key, and then ... I mean, Satin Doll might not be so bad, but try playing All the Things You Are in a key other than A flat. See how well you do. [both laughing]

PP: It's true. I don't think I could. I can barely play it in A flat.

BM: I know. That's a rough one.

PP: Ok. If you weren't memorizing it ... Let's say you had to memorize All the Things You Are in G flat ...

BM: Or gotten used to it in a different key other than A flat ...

PP: Would your process of memorization that you used for the Mozart sonata be similar or dissimilar to your process for the jazz piece?

BM: I don't think it would be ... No, it wouldn't be ... No, I would not use the same process.

PP: Oh, you would not use it. What would be the ...

BM: I would just play it a couple of times ... That's basically simple. But, again, you brought up an interesting point because I play jazz, but I don't consider myself a really great jazz player. And I have to know if I have to do certain things in jazz, especially if it's a show where you have to do it over and over again. I have been known to cheat and memorize [can't understand this word].

PP: Oh, yeah?

BM: Yeah, yeah. Absolutely. I just did that last year.

PP: Well, I think even jazz musicians do that in recording.

BM: I do that a lot. I remember a long time ago when I was a student and Peter Nero was king; Brendan Vine, who was the jazz pianist, went to hear him, and he was like really turned off because he saw him live. He said, it's solo (??) from note to note, the same as the record. All the improvisations were like ...

PP: Peter Nero, I think, is mostly [can't understand this word]-trained, so he probably relies on that whole melodic thing. If he likes something, he's gonna keep it. Yeah, I would feel cheated too if I went there. ... You mentioned you're a composer also. Can you tell me what kinds of things you've written?

BM: Well, I have my own separate little career as a classical composer, which I do because I enjoy ... I like doing that. And I've written not a lot of music ... ah .. because ... Well, Ok, let me go back a little ways again. I'm a composer who does not like to compose. I hate to compose. I hate ... hate ... hate ... writing music. I love having the finished composition. I love rehearsing my original composition. I love performing my original composition. I love everything about composing except doing it. So consequently ... I haven't written a great deal. I've written about five concertos, most of which have been ... All except one, which has been performed ... five or six concertos and a bunch of smaller pieces ... chamber pieces ... piano pieces ... two or three song sets.

PP: In what style do you find yourself?

BM: Sort of early 20th century ... very melodic.

PP: Stravinsky-ish?

BM: Stravinsky-ish. Prokofiev-ish. Harbury-ish. I'm a little more atonal when I was in school, and the older I get, the more tonal I become, and the more conservative I've become.

PP: That is true of a lot of people.

BM: Yeah.

PP: When we're done, I'll mention something to you. Overall, do you find it easy to memorize?

BM: Yes.

PP: If you had to choose something about the whole process that maybe makes it a little bit troublesome at times, what would that be?

BM: Ah ... Ask me again. I'm not sure I followed you.

PP: Ok. In other words, you said that you find it easy to memorize.

BM: Yeah.

PP: Ok. If you had to choose one element of the process of memorization that might give you trouble once in a while, what aspect might that be?

BM: Only memorizing words ... can't do it. It would be great if I could do shows and know all the lyrics. [laughing] Did you see Showboat?

PP: Yeah.

BM: I had an incident about the second performance ... when I'm on stage ... Julie came out before Bill, and she leaned over and she said, "I don't remember the words. What are the words? What are the lyrics?" And I looked at her and I shrugged my shoulders.

PP: You're on your own, baby. [laughing]

BM: You're on your own, baby ... Which is so funny because I thought about putting the sheet music up on the piano ... the real sheet music. And I said, no, I won't bother with that. I'll just memorize it. It'll be easier. So I memorized it. I mean, what the hell, it's just Bill, you know. It's just my Bill. And so there was a fake piece of sheet music up there and no words ... and she made something up.

PP: Oh, wow. I can't imagine what that would be like on stage. You know, it's funny. I accompany a jazz singer quite often, and we do ... I sing also, a little bit.

BM: Oh, really.

PP: So, we do some duets. But I only memorize the words that I sing. The other night we were doing a gig and she got stuck ... She sings the beginning and I join her on the refrain ... on the bridge, rather. And she said, what's the next set of words. And I've heard her sing it. We've been together for over 20 years, and I could not help her. I was so embarrassed. She said, "You are not listening to me when I sing, are you?"

BM: That reminds me of the old joke about the pianist and the violinist performing. The violinist had a ... these are real people, too, supposedly ... a real story. The violinist had a tendency to get lost, so we were playing this Prokofiev sonata and sure enough the violinist got lost and leaned over the pianist, and said, "Where are we?" He says, "Carnegie Hall." [both laughing]

PP: How often do you perform from memory?

BM: Well, I stopped giving recitals. I used to give recitals about once a year or so, and I just have trouble finding an audience, so I don't really do it that much. But I mean I use the whole process of memorization all the time ... in my work ... in doing shows and stuff. Most of the time I'm not even aware of what's memorized and what isn't. It's just something that you use on a daily basis.

PP: In Showboat, did you play a lot. I couldn't tell from where I was sitting.

BM: Well ... I've developed a gateway style ... I've used it other places too, but it evolved here. I play with my left hand and conduct with my right. So I do it all the time. I

play through everything, unless for some particular reason I decide to play piano. But I only play with one hand ... basically.

PP: I usually like to peek in [both speaking together ... hard to understand]. I couldn't see you. I saw one guy conducting Les Mis. I got a good shot of him, and he was ...

BM: Was he conducting the piano?

PP: No. He was just solely conducting, but I was trying to notice if he had it memorized or not, and I noticed that he wasn't turning every page, and that he would have to sometimes scramble ... and then four, five, six pages have gone by, and he realized that he didn't know what was coming up, and better get to it.

BM: Yeah, it's scary conducting without music because you never know when somebody's gonna get lost and need measure numbers.

PP: Yeah. I'd be very shy about that. I don't like playing while I'm conducting. I did Big River not too long ago, and that was a nightmare for me because if I'm playing I like to concentrate on playing, and if I'm conducting I want to concentrate on conducting. Mixing the two ... Playing one-handed would have been a good way out of that. I didn't even think of that ...

BM: Yeah, that's what I do. Because I like to ... If I'm going to be playing the piano, I like to control the piano [sound fades out] ... Especially a show like Showboat where it's just piano from beginning to end. If it's a show that's rhythmic, then you don't have to do that. Once the tempo is established, and you've got a good drummer, you don't have to do that. Just let the drummer do the time.

PP: I was looking at your score and I noticed you draw lines in the beginning of different pieces. Do you do that to remind yourself ...

BM: That's something I picked up from Broadway ... just shorthand for how many beats ...

PP: Right, so you don't start conducting something [hard to understand] ...

BM: Exactly. Exactly. I do that ... When I'm playing as well ... If I'm like, pit pianist, for me to know if the conductor's in 2 or 4 or 3, or whatever, and especially when there's a lot of changes ... which, there were a lot in Showboat ... from 2 to 4 to 3 to 1 ... Surprisingly enough ... I was surprised to see that when I started learning the score.

PP: How important is confidence to you ... in terms of both memorization and performance?

BM: Well, I think confidence is really about preparation. If you're well-prepared, then you can be confident. If you don't do the homework, which I have not done on occasion ... Chorus Line was a good example ... I went into A Chorus Line because we spent up until the very last minute struggling with the producers ... They were a mess. And Paul and I just worked on that the whole time, and I did not have time to work on music. And I was very disappointed. I wasn't prepared. But I think it's really about preparation.

PP: That's a very good point. Just give me examples so I understand when I reread this and transcribe it. The types of pieces that we're talking about that you did have to memorize, could you give me, like, some examples of what they were ... the titles, the composers ... so I can have a reference?

BM: You mean ... of ....

PP: Of pieces that you have performed ...

BM: Classical music?

PP: Any type of music ... classical ... from shows ... It doesn't matter. Just so I have a reference.

BM: Well, basically, from memory I usually only consciously memorize classical music. And that's the standard repertoire, you know, Bach ... Although, I will say this ... I found that Bach is the hardest stuff to memorize and play of anybody ... for me.

PP: Why?

BM: [Sigh] Because it's so damn contrapuntal. You know, you're not one person. You have to be two or three people. And it's really very hard, and one little slip in one of the lines, you know ... and it's curtains. I have not found that with any other composer ... you can fake your way through Mozart, Beethoven, even Schoenberg, Prokofiev, the modern guys. You can fake it. But Bach is very difficult to memorize.

PP: I agree with you.

PP: Just on the average ... of the pieces you did memorize ... in terms of difficulty, they were professional ... How would you rate them in terms of difficulty?

BM: To memorize?

PP: No, not to memorize. But how difficult were the pieces themselves?

BM: Uh. I'm not sure I understand.

PP: Level of difficulty. How hard were they to play ... overall?

BM: Well, some of them were ... a lot of them I'm still working on. [laughing]

PP: Ok. I just wanted to ask ...

BM: I mean late Beethoven sonatas ... forget it. Very hard.

PP: Ok. So these are not middle-level pieces. I just want to establish that. These are professional pieces that are normal repertoire for someone who gives concert tours, or whatever.

BM: Absolutely. Yeah. I have this thing ... I love, like, classical music, and I love performing it. I mean I love playing it. And I ... Over all these years, even though I don't give recitals anymore, I still practice as much as possible because I feel that ... in working on this very difficult music, it makes the music that I do professionally ... like shows and stuff ... a piece of cake. It's a matter of discipline. It's sort of like a ballet dancer doing bar work. You know, it keeps you in shape for whatever you have to do, you know, in your musical life. It keeps you on your toes. It's discipline, as well as enjoyment.

PP: Right. These are just general questions now. How ... Where have you performed? I mean, you do a lot of musical theater.

BM: Yeah.

PP: When you're in New York ... You're from New York?

BM: No, I'm from Ohio.

PP: Oh, Ohio. Ok.

BM: Columbus, Ohio. And I've lived in New York for over 30 years. And in theater I've performed all over ... all over the United States and Europe, basically. United States and Europe. Never in Mexico. Never in Canada. Yeah. United States and Europe.

PP: Ok. Thank you. That's pretty much it.

BM: Good.

PP: Excellent. Thank you so much for your time.

Interview with CC

PP: Ok. Today is ... what's the date? The 26th.

CC: Yes.

PP: 26th of July, 1999. I'm talking with Chris. Ok. I'm going to ask you some questions concerning your musical memory. Keep in mind that there are no right or wrong answers. I want to see if there is some pattern that will develop between different people that I speak to. ... How do you go about memorizing a piece of music?

CC: Let's see. How do I memorize a piece of music? To play it again and again, and it sticks in my ear, and it just gets committed to memory by itself. I don't usually set out to do it.

PP: Ok. You mentioned your ear. You have a wonderful ear. You have perfect pitch, right?

CC: That's correct.

PP: Do you find that enhances your ability to memorize?

CC: Oh, very, very much.

PP: In what ways?

CC: Sometimes years later ... I haven't played a piece in a long time ... sometimes even years later I still have the tune in my head and I find out that if I start playing it even without the music in front of me, it translates somehow into muscle memory ... for my fingers. I just find that I'm doing the right things because it's kind of already

tucked in my ear and it forces my fingers to kind of remember it. Because I'm just basically uncovering what's kind of still there. And I have the basic tune already in my head, so it's just kind of ... The details are just kind of fleshed out when I play it. But the basic tune is already there.

PP: Ok. So you remember melodic contour and that kind of thing.

CC: Chords mostly. Chords ... and really, just the whole thing. I hear things more ... well, a certain amount vertically and a certain amount horizontally. They're not separable in any way. But the way that it comes to memory is just by playing it again and again. Usually, by the time I've sat with a piece long enough, I don't need the music anymore, and that could go on for long stretches of time ... months, years. You know, and if I do have to refer back to the music, it's usually just to touch up the things that I'm not quite doing.

PP: What do you mean by vertically?

CC: Up and down. Chord-wise. As opposed to linearly melodically. Chord-wise. I hear from one chord to the next. I'm able to tell what they are ... major and minor. What specifically ... the root name ... all those kinds of things ... just by listening.

PP: How complicated can that get for you?

CC: You mean the kinds of things I can interpret? Or ... Very complicated, I think. More than just primary chords.

PP: Ok. If I play a jazz chord with a sharp 11 and a flat 13, you'd be able to tell me what those notes are?

CC: The notes, yeah. I may not necessarily put the labels on them so quickly, but I could tell you, oh, it's this chord, and play it. [laughs]

PP: You mentioned motor a minute ago in response to the last question.

CC: Muscle memory?

PP: Yes, you mentioned muscle memory.

CC: Um. Just ... There's almost a sense that my hands seem to intuitively know what to do if I have it in my head. If I've forgotten little stretches of it ... little segments of the piece ... my hands almost seem to have a memory ... a muscle memory ... of what to do. And it's drawing its information from my ears, and it just kind of happens, and it just seems to fall into the right place. I guess if you play something often enough, and then you put it aside for maybe a year or two, you've done it so many times, there's a certain memory that comes from that ... that the muscles just seem to want to do on their own.

PP: You mentioned the muscle memory. Do you feel that that's a brain function, or is that more like a kinesthetic feel?

CC: I think it's more of a brain thing than anything else. Sometimes I have a sense that my hands should be moving in a certain direction because they've done it so many times. But I don't always know why. I think it's just more from the brain more than anything else.

PP: Ok. Do you use a kinesthetic feel for some things?

CC: Yeah, some things. I'm just not very good at it. [laughs] Yeah, it's one of my weaker things. But, yeah, definitely. It's part of it.

PP: You're the only person I have that has perfect pitch, or absolute pitch. You mentioned before that you felt it was really enhancing your ability to memorize because ... Restate that again so I get a clear picture of what you mean.

CC: Because initially, I mean, all of my ... The whole way that I memorize music is really just through listening. And it speeds up the learning process for me. I know how it should sound, and very often I'll try playing a piece ... before I even get the music for the first time ... just for pleasure. And then when I get the music I'll fill in some of the things that I wasn't doing exactly the way it was written. So it's already there. I'm hearing it, and I'm just kind of now putting onto the keys what was already in my brain, and I'm already processing, or have processed, that way.

PP: Talking about ... The first question was regarding your musical memory, and we talked about absolute pitch. How do you ... What aspect of the music strikes you first?

CC: Chords.

PP: So the harmony is what you go for first.

CC: Chords and the melody ... because they're really to me inseparable.

PP: Ok.

CC: Much like Handel would do, he would have a single melody and then the chords would be supporting that. Unlike Bach, who would have all counterpoint going on. So Handel for me is a lot more relevant in that regard because it's just ... that's how I kind of experience the music ... a melody supported by chords.

PP: Ok. So with your memory you then ... You look at the harmonic structure and as far as your memory is concerned, do you have a good memory for seeing how one chord blends into the next?

CC: Yeah, I think so. Yeah, it's all part of the same experience. It's so hard to separate them because it seems like it's all the same thing for me. It's just ... It's music. And it's just the way that I hear that ... I don't normally isolate the elements. It's almost like looking at the picture and seeing the whole forest instead of individual trees. Although there's a high amount of detail in what I do at the same time. So it's hard to separate the two.

PP: Ok. But when you're listening to a piece or you want to learn a particular piece and you want to memorize it ... Let's go back to hearing a piece. If you hear like a one-chord to a four-chord, do you hear it as a one-chord to a four-chord, or a CEG going to an FAC?

CC: Yeah. The second way. Yeah. I don't even think of them in terms of the numbers. It's just absolutely this chord going to absolutely whatever chord it is by name. Yeah.

PP: That's amazing. Ok. So you're memorizing a piece of music, and your first step is to look at the harmonies. Am I correct in assuming that?

CC: Ah. Again, I don't look at the harmonies. I hear the harmonies that are ... When I play the chords, I'm listening for what they actually are. And through repetition, they just get committed to memory.

PP: Ok.

CC: I do a little analysis of what I'm playing. Whatever's there, I listen for. And if it's there, I'm aware that it's there. So if it's an E minor chord, I say, ooh, an E minor

chord. That just came out. And it starts to put a sequential thought process together ... a musical process. So it's like, well, it started with E minor, we went to A minor, etc., etc. And it just has a certain direction to it.

PP: So your approach is less analytical and more intuitive.

CC: Absolutely. I did very poor in analysis overall because I felt like I was trying to put all these labels on things that were unnecessary for the most part. Except for the point where it might be interesting, but after a while, it's like ... just play it and listen to it. You know. Who cares? It just is.

PP: I'd like to trace now the steps that you ... I know that you do it instinctively, but I want to even go inside your brain a little bit more and see if there's some kind of pattern or some kind of order that at least [tape jumped]. Let's see if we can pinpoint that. I'm going to reword what you said before ... that the melody and the harmony are pretty much inseparable. You see them as one unit. Are there elements of the musical process that you look at this time?

CC: [tape jumped] Again, you can't have those two without the rhythm also because that's the foundation of it all. I don't know. It's just like ... Like I said, it's trying to think top to bottom at the same moment. I may be able to tell you at a given moment ... That was an eight-note C sharp with an F sharp chord, and then there was an A sharp in the bass. And that's what I hear at that moment going up and down. The next moment will be second chord and I can do the same detail, but I'll also be able to tell you that there was a linear connection between the two moments in music. And it just starts to put a puzzle together. The rest of my life ... if you will ... works the same way. Nonmusically, I'm very detail-oriented also. I have a memory for fine details. I'm very much a visual learner. If I've been to a place once, I could probably remember for years after in fine detail. I could probably describe your old house in high amounts of details ... colors, designs over the doorway, and the color of the green kitchen chairs, and the

tiles in the kitchen, and all the other things, which room ... who had what room ... where the computer was in the room, the color of the bedspreads, things like that ... in high amounts of detail. It's just the way that my mind processes ... Because there's a sequence to that also that just ... It's just a whole puzzle. It's the detail, but it's the whole thing at the same time.

PP: Is that something you strive for, or is it something that comes?

CC: No, it's just there. I don't know why. It just is. I remember your old car that you used to drive ... you know, Patty's white car, for example. You know, little tiny things about the whole thing. How to get places after I've been there only once ... trying to find my way back. Because I make an image in my mind of what it should look like. And if I have a model to work on, you know, I'm a visual learner. And I could even do that with the music sometimes. I could make a map in my mind as to what should be happening next in the memorization process. If I'm trying to get to really make it a point to memorize a piece, I could start putting a visual map in place as to what should be next ... arrival chords ... and I'll have an image of what the chord will look like somehow in my mind ... or sound like.

PP: A photographic memory, then?

CC: Not photographic, I don't think. Somewhere between sort of and yes. But not truly photographic, though. No.

PP: When you conduct ... Do you have a choir at school?

CC: Yes, and at church too.

PP: And at church.

CC: So I have young kids and older people.

PP: Do you need to look ... What do you see in your mind as you're conducting?

CC: Well, I'm usually at the keyboard, but if I weren't, I'm ... again, I'm more listening to the piece in my head, so I know which entrance is there because I've heard it. So I know the cue that should be there. And they should be there, and they're usually not because they missed their ... [laughs] You got that on tape?

PP: I do.

CC: We got to erase that part.

PP: The reason I asked that question ... I've interviewed a number of people, and one gentleman who's an instrumental music conductor claimed to see the score in his mind ... not more than one page at a time, but it was almost a flip ... a visual flip in his mind.

CC: Well, that's interesting. Because I could tell you exactly what page everything's on ... the way I can remember the ... you know ... the way I can remember the model of your old house. It just ... It belongs there. So I know that that's probably ... I know that's the last measure on page 7 because that's just where it always was. So they'll be ... If I want to make it a point to think about it, they'll become inseparable also. Those two thoughts. If I decide to think of it in those terms. I don't usually, but if I am, I know that that's the page turn. I know that that's the middle system on page 4. It's just the way I start to think of it after a while. Those kind of memories last less lengthy than the musical memories themselves, though.

PP: So you're pretty shocked that I got lost getting here. [laughing] And you talked about rhythm, and that's also a part of what you see, or hear actually. Do you compare your rhythmic memory to be equal to your harmonic and melodic?

CC: Yeah, I think so. Yeah. Because I just ... Like I said, I can't take one away from it. It's all part of the same experience.

PP: Articles I've read seem to purport this idea that in words people can memorize seven plus or minus two words, and I've read a couple of articles that talk about melody, and they seem to feel that melody is a little longer because you can chunk them together. So they feel it's more like 11 to 15 notes in a row. But with your kind of memory, you could probably do the whole piece, and that wouldn't bother you because you have this ability.

CC: You mean in one hearing?

PP: Um hum.

CC: No. Definitely not. No. I don't even know if ... I don't even know if my auditory recall is necessarily any different than anybody else's, but the difference is that once it's there, as I'm hearing it, I'm experiencing it differently. So they might be hearing an interval of a major 6 and I'll just ... I'm hearing the names of the letter notes. I'm naming them as they go by. But it doesn't mean that necessarily ... that I'll be able to give it back any sooner. But once it's there, it's usually there for good. Once it's there. It's there for, like I said, for a long, long time ... if I choose to try to commit it to memory.

PP: If I played for you a C up to an A, where I would have to sit and think, that's a major 6 ... you would sit and say he played a C to an A.

CC: Oh, yeah. I wouldn't even think of it in terms of a 6 necessarily.

PP: So you'd have to go backwards, then?

CC: Yeah.

PP: If it was a course you were taking in ear training, and the question was, what is this interval? ... you would have to do the process backwards.

CC: That's right. Although at this point, with the simpler intervals ... at this point, I can do both pretty interchangeably because they ... now they become inseparable because of all the training. But initially, in the early days, I absolutely had to do that. It's like, oh, yeah, they call that a 6. That's right. Yeah. But it was definitely the other way around. Yeah, it was backwards.

PP: Ok. You were contrasting the styles of Handel and Bach before. And you said that because Handel is more vertical in his approach, whereas Bach could be more polyphonic in a way, does that help or hinder your being able to memorize something? ... whether something is more linear rather than more vertical?

CC: Yeah, if the texture is thicker, again, it's more difficult. Although I could ... Again, if I played Bach enough, then I'll start to memorize it because I'll have actually ... When I'm listening to all this polyphony, I'm not hearing it as ... I'm still hearing it as if it weren't. I'm still hearing chords and directions with a melody, even though I know ... I have a sense that a lot more's going on there. It's too much to interpret all at once, unless if I really focus on one melody at a time. It's a lot harder to do that. So then if I get the score and I start to play them, and now I'm seeing, on the page, and also I'm hearing what my fingers are doing linearly, and I'm actually doing the creating of what's on the page, then I start to commit even the polyphony to memory also. Because I'm actually ... Now I'm starting to hear it clearly. You know, it's almost like me trying to hear jazz solos. I can't really hear them very well because they don't always make ... um ... tonally, they don't always make linear sense to me

because they're going in and out of the key a lot. So it's hard for me to interpret those. I'd have to really ...

PP: So you have a strong sense of tonality in the way you approach a piece.

CC: Yeah, unfortunately. It's a limitation sometimes.

PP: Do you think that's a limitation?

CC: Yeah.

PP: Or do you think that's because of the way you've been trained?

CC: Both. I also think that I have a hard time hearing, like, atonal music in general. It doesn't make any sense to me at all. It just doesn't compute in my brain what's going on because it's ... there is no sense to me whatsoever.

PP: If I played you a piece by Handel right now ... one that you've never heard, which may be unlikely ... but let's say I was able to play one. What would you be thinking of as I was playing?

CC: Ah, where can I get the music. [laughs] No. I would ... Chords, bassline ... almost like figured bass. And then the melody would also be ... again ... inextractable to a certain degree. But the first thing I would ... Now that I think about it, I'd be hearing chords and progressions on where it's going. [tape skips] Kind of like Bach, even with a lot of polyphony, I'd still be hearing it, like I said, in chord progression ... still going from chord to chord.

PP: All right. So if I played a Bach chorale ... an eight-measure phrase of a Bach chorale with four parts, how many times would I have to play that, do you think ... I know this is a strange question ... before you could notate it for me?

CC: Thoroughly ... exactly ... with all four parts?

PP: Yes.

CC: [tape skipped] Four ... for eight measures probably. Maybe five. I would say probably about four or five times. Because the first thing I would be listening for, without a doubt, would be the soprano line and the bassline, without a doubt. And I would try to fill those in as quickly as I can. While I'm doing that, I'd be aware of what kinds of chords that would create. Therefore, you only have certain choices on the middle voices. And then I'd try to really focus in on the middle ones. I would spend more time on the middle voices than anything else.

PP: Would you think more harmonically, then, or would you go back and say, okay, I remember the alto line went this way?

CC: I probably ... I'd probably still be listening more for each part, note by note. Yeah. And then I'd make sure that it didn't ... I'd make sure that it didn't ... I'd make sure that it's spelled ... that it at least sonically produced the chords I wanted it to ... even if I was somehow wrong, it would still be an A minor if it was an A minor, even if I had the two inner parts reversed. I'd have to at least make sure that it made sense that way because I'd still want it to sound like an A minor chord. I could play it though. I could play it a lot faster than I can notate it. How quick could I play it back? I could probably play it back ... probably after the ... maybe the second hearing. Notating the inner parts ... you know, that's more ... Now I'm not saying that it would be necessarily 100 percent accurate on the playback, but all the chords

would be right, and the bass would be right, and the soprano would be right in 3+1 style.

PP: Um hum.

CC: That I could probably do after the second time ... maybe. [laughs]

PP: How would you measure whether you have been successful at something you've tried to memorize?

CC: Ah. If I don't need the music at all. If I don't need the music at all and I can play it and ... as I'm seeing it, I would have occasional thoughts of where I am in the music ... what page I'm on. I would think of it in those terms. And just being able to play it from memory over and over. If I didn't need the music, then I know that I've memorized it. And I know that would stay with me, like I said, for a long time.

PP: Ok. If I gave you a four-part Bach chorale, standard, whatever it is, 32 bars. How long would it take you to memorize that?

CC: Probably a while. Um. I mean, doing it in detail, like anything else. I don't know if there's any kind of music that's harder or easier to memorize, because it's the same sort of process for me. So it doesn't really much make a difference. Um. That's a hard question to answer. I just don't really know.

PP: So the style doesn't really matter?

CC: No. Not really. No.

PP: So if I gave you a piece by Mozart, or ...

CC: Yeah, I'd say so.

PP: ... or a sonatina by Beethoven, that wouldn't ...

CC: It wouldn't make much of a difference. It's just ... certain styles, just from a musician's standpoint, are harder to play than others. So that's what would be the difficulty, but, you know ... When I do, for example, all my work at the church and I play hymn tunes, or any of the music I do for that matter, I never use accompaniment. I just ... I need to see the words, and if I know the tune, of course, and I usually go from that point ... I can play them in any key. It doesn't make a difference as far as that goes. And sometimes I will transpose depending on the setting I'm in ... the situation. So ... And that's another thing. If I do know I've memorized something, I usually could transpose it accurately in any key if I've memorized the piece. If it's something I'm just winging and making up, I can definitely do it in any key that I want to do, which is nice.

PP: Tell me about that process.

CC: About which?

PP: Let's say ... Let's take just a short piece by Mozart ... a piano piece. Let's pretend that you've spent time and you've memorized it, and you have it ingrained in your brain. You're telling me that you could ... If it's in the key of C, that if I said, play that in the key of D, that would be no problem?

CC: Ah. I'd make a few mistakes, but not because I ... I don't know what the mistakes would necessarily come from, but ... only because I probably did it so many times the other way, maybe my muscles would just make the mistake. But I wouldn't be thinking transposition. I'd be listening to it in a new key in my head now.

PP: Wow.

CC: That's the difference. I would just start to hear it differently.

PP: Ok. That's very interesting. That's more than intuitive. It's more right-brained ... if you had to choose which side of the brain you were probably utilizing, because if you were thinking transposition, that definitely would be more analytical and more left-brained. But the fact that you can do that creatively just instinctively and using your more intuitive side of the brain ... is probably right-brained.

CC: Well. Yeah, I guess. I guess the other thing is that I don't ... It would also sound very different to me too. It wouldn't sound like the same piece ... I mean it would sound like the same piece. I'd be quite aware of it. But, I mean, even D flat as opposed to C would sound very different to my ears as to the overall quality of what I'm listening to. Very different.

PP: What sounds different?

CC: It just ... C sounds like a C. D flat sounds like a D flat. So ... I write often in flat keys. They tend to sound a little bit more mellow to me usually. Um ... more ... what's the word? ... just deeper, emotionally. They pack more of an emotional impact. And the diatonic notes have just a brighter sound overall to me.

PP: Do you see color?

CC: Yes, sometimes. Yeah.

PP: I had a feeling you were going to say that.

CC: Yeah. Chords more likely than anything else.

PP: Tell me about that.

CC: G is always green. E minor is always brown. That kind of thing.

PP: What's E flat?

CC: Not all of them have colors to me ... because those are primary things I was doing when I was younger and when I was first experiencing music.

PP: Do you have a sense of E flat? I'm just curious, because that's the only chord that I get a sense of color from.

CC: What color?

PP: Blue.

CC: No. I wouldn't. But mostly C would be red usually, if anything. But mostly E minor is always brown ... always brown. And G is always a greenish type of thing. But that goes back a long way. So some of them, I might have even had more when I was little, and don't have them anymore ... the color associations anymore.

PP: Do you see the color in your mind?

CC: If I want to be aware of it. Yeah. Most times I have to think about it. Not too much when ... Again, when I was younger, that was my first experiences when I was four and five. They used to come a little easier, but now I'm doing so many other things simultaneously.

PP: I wonder if because there's a color relationship between green and brown, there's also a relationship tonally between G and E minor. I wonder if that has any bearing on this.

CC: I don't know. I didn't even know there was a color connection. I'll take your word for that. I think part of the reason G is green is because the organ that we used to have had all the things labeled ... the pedals. But they had green stickers on every pedal. And I guess I must have used G a lot and I started to just associate that particular pedal with green. E minor ... I don't know why brown. It just is a color that ... [muffled]

PP: This is not an aural sense of tapping in that mystical place between music and color.

CC: Well, no, E minor would be. I don't know why that at all. I have no idea why.

PP: Brown, huh?

CC: Yeah, it's just always a sense. It's that somber, brown yuck type of ... I hate brown, too, by the way. It's my least favorite color. I wouldn't say E minor is my least favorite key, necessarily, although it's not my favorite. But ...

PP: Just for curiosity, do you have any other colors that pop up in different keys?

CC: I can't really think of too many others. Except, like I said, maybe occasionally C would be a red because it's that majestic, bright type ... because there's a majesty about that thing, which just ... no one told me that. It just seems like there is. You know, that's just trumpets and all that, which is ... [break in interview]
So C is this majestic thing. It just always had that sound, you know, trumpet fanfare, whatever. It just ...

PP: But I'm less concerned with what you emotionally ... [phone call interrupts interview] Yeah, you were saying it sounded like more of an emotional response that you see ... the key you see as a majestic trumpet and flaring in red. But I'm more interested in knowing if you just perceive a color.

CC: Yeah ...

PP: ... without trying to separate the emotional with the ...

CC: Yeah, definitely. Like I said, mostly with E minor for some reason, it's just brown for some reason. I don't know why. It just is.

PP: But it's funny. I can see that. And I don't know why. It's kind of scaring me in a way. But I always envisioned E flat as like a bluish green, for some reason ... more blue than green. But that's neither here nor there. Ok. What elements of music are you conscious of when you're memorizing?

CC: Well, like I said, mostly chords ... bass line ... melody and rhythm, I guess. It's hard ... I just find it hard to separate any of them. They just seem to all go together. It's just the way it should sound. There is no other way. In this piece, that's the way it's written, so that's the way it should be.

PP: Ok. So those are the three or four primary elements.

CC: Definitely.

PP: What about the others?

CC: Well, as far as vocal music, the last thing I ever notice are the lyrics. I almost never know what most songs are about. Any of them. I could hear songs sometimes for

years and years and years and never listen to the words. And then one day say, is that what they're singing? Because I just don't make it a point to ever concentrate on the lyrics, which is not always a good thing, but ... that's the least important, probably. Because theoretically you could take the same music and write any words, I guess. So that's the least important aspect.

PP: Let me ask you about articulation. Is that ...

CC: Again, inseparable. It's just ... That's just the way it is. It's not always in an F, but it's playing staccato. It just is. It's just the way it sounded, so that's the way it should be. You know, especially if you have a recording and someone has a preconceived idea before, and you're listening to it. So now if I were to try to play something that I heard someone doing and I got the music to, there would be no way ... even if it wasn't written in the music that way. If it was a sloppy job of editing, and they didn't write that F staccato there, I'd still play it that way because that's what the guy did on the tape.

PP: So you take like almost a musical snapshot ... moment by moment.

CC: Yeah, I think that's very well said, actually. If I had to find words to put it into, I'd say that's probably very accurate ... a musical snapshot ... for a moment at a time. Almost like a musical cartoon because the frame rates change to the next ... the frames, rather.

PP: Ok. If you're trying to memorize a piece of music, and somehow get distracted or interrupted, I was trying to ascertain from different people how they get back on track. Is there a problem getting back on track? Is there something they say ... ok, now it's got to wait until another day? Or? Does that inhibit you at all?

CC: Oh, no. It's just putting the recording on again, if you will. I find that ... What's interesting is that I'll usually ... It kind of happens in stages. If it's a three-page piece of music, you know, I might be well on the way to memorizing all of page one while I'm on page two. While I'm learning page two, I might try to play page one up to that point and see if I could do it. Sometimes I'll stop in the middle if I know it's wrong, and try to just use my imagination to try to see if I could remember and pick it up from there. But that's how I know ... Usually when I'm at the end of the piece, I'm not usually playing the first ... I'm not usually using my eyes for the first x number of pages. I'm usually using them toward the end. That's how I know I'm well on the way. So it happens in stages. If I put it aside for a few hours and come back, very often I can remember parts that I really practiced very well and ... Most times I'm playing pieces, though, that I already have an idea ... I can usually hum the tune already. Usually I'm not learning something from scratch. I'd either heard it before ... and then I want to go get the music because I like it enough to do it. I don't do a lot of just ... let me just look in this book and just see whatever I can play. I don't usually do a lot of that.

PP: So as far as memorization goes, you're more aural than visual.

CC: Oh, without a doubt.

PP: And you're more photographic in the sense that you seem to be able to create some use of a moment in time, and re-create that in your mind. Would that pretty much say it?

CC: Yeah, I think so. Um hum.

PP: Ok. You were talking about being distracted. Let's say you were memorizing a piece of music ... it's a three-page piece of music. And after you've pretty much

gotten page one down and you were beginning page two, Peter wanted his lunch and you took a 15-20 minute break and came back to it. Where would you be at?

CC: Probably just doing page one again, probably. I don't even know if I necessarily memorize any quicker than anybody, but I know that when I do memorize it, it's usually there for just a long time afterwards. Usually. But I don't know if I necessarily attain memorization any quicker. And, like I said, one of the things that tells me I'm on the right track is that I'll start using the page less and less during whatever practice session I'm in. It might be the 10th time I'm sitting with the piece, if it's a hard one. And at this point, now I don't need the first six pages because now I keep doing those. Now I got that, but now I keep getting stuck at page seven. I need to see what's next. And a lot of times, it's just trying to fine tune the things. Again, if I did my own version, I could probably come up with a close facsimile. But now I don't want a close ... I want THE EXACT piece. So now I want to know exactly. You know, this time it's like it's slightly different in the bass. This time is variation. And I want to know the subtle things that fill in all the details. Aside from that, I could probably make up my own version. But that's not what I want if I'm trying to memorize. So that's ... those kind of things. Variation, I think, is the hardest thing for me to memorize. That's the hardest thing because now we're talking about subtle differences from one time to the next. And that's just repetition.

PP: All right. I'm unclear what you mean by that. You mean like actual variation? Like a Mozart children's piece that has multiple variations?

CC: Maybe that too, but ... Those are actually more diverse than ... No. Like if I wrote a piece and then my accompaniment ... the second time around I might bring a certain passage up one octave just for variation. But it's the same basic idea. I'd have to remember ... not the first time, the second time I did that ... I have to remember that consciously, to think about that. Until it becomes so ordinary. Or I re-harmonized

it just a little bit differently this time just for a little variety. Or if you have a refrain that keeps coming up and each time you play it slightly different. That's harder for me to memorize because they're very similar, but they're interesting enough so they don't get boring from a composition standpoint.

PP: Do you find different octaves are easier for you to memorize?

CC: No, not really.

PP: If I played you a lullaby using all high, tinkly notes, that would be just as easy for you to memorize as another piece?

CC: I guess, because to me, notes are notes. They're pictures, whichever.

PP: Do you hear actual frequency?

CC: Meaning what?

PP: Could you sense ... this is theoretical, I just thought of. Well, we know that this is an A440. That's relatively close on a acoustic piano. Do you hear that as cycles per second, or do you ... You don't hear that?

CC: No, but I would hear if something was 444. Maybe I would notice that. That would say that's different. It's not exactly ... It sounds a little sharp. It sounds a little flat. It's still an A, but it's not quite an A flat yet, or it's not quite an A sharp yet.

PP: Ok. So listening to an elementary school orchestra probably would drive you crazy.

CC: [laughing] Not really. But playing an instrument that's out of tune would, though. If it's more than a half a step away ... I almost couldn't do it. I just couldn't.

PP: It drives you crazy.

CC: I would keep making mistakes. I'd keep reaching for notes expecting they'd sound like something, and I'd keep making a mistake because they're not what they sound like. Any more than half a step, I probably couldn't play the instrument. I'd have to really think. Then I would have to do it all by just analyzing what the chords would be or should be, and then have to do them ... just watch my fingers play certain chords. Because I know that when I hear them, if I don't hit the right notes ... visually ... if I'm not watching me hit D flat, D, F, then I'm gonna make a mistake. So I'd have to watch and try to intentionally hit it ... and almost ignore the sound because it just sounds so funny to me.

PP: So I think we had this conversation before when we were talking about the electronic keyboard. That you would have a problem putting on the transpose function.

CC: Oh. I just wouldn't use it because I would just transpose it on my own. If I want another key, I'll just play it that way. Because it would just ... I couldn't play it. I'd make too many mistakes.

PP: Because why?

CC: Because it has to sound a certain way when it hits a certain key, and if it doesn't ... I'd keep reaching for things, thinking it was gonna sound a certain way. Then I'd try to correct it by reaching for another key. And that would be wrong. It would just be like an endless chain of mistakes.

PP: I can imagine. A lot of these questions are almost moot, because you have a peculiar ability to ... with your perfect pitch and your ability to memorize ... so some

of these may not be applicable, but ... Approximately how many pieces could you perform from memory? Probably hundreds.

CC: Yeah, I would think. Yeah, if I knew them, like I said, usually they stay with me for a pretty good long time.

PP: Now when we were on the phone a minute ago, you played an old piece of mine. When was the last time you played that?

CC: Oh, I don't know.

PP: Probably the last time we were together ... a year or two ago.

CC: Easily. Even more than that, I'm sure. Yeah, I still can't play it like you can, but the chords were more or less right.

PP: They were absolutely right. That's what scares me. When you played that back just now, were you relying on ... Were you seeing the music in your head? Were you hearing the music and re-enacting it? I'm just curious.

CC: It's just there. It's present in my brain. Like right now, I could think of it.

PP: So you're just exuding what you remember. It's like reciting a poem. You know, "Little Miss Muffet." To you, it's just musical Little Miss Muffet.

CC: Yeah, whenever I turn it on ... turning on a switch. It's like now I want to hear Peter's song. And I would do that. Which is funny, because like I said, when you get to the solo stuff that I remember you did on the sequence, I can't ... You recorded that so many years ago ... I couldn't do that because after a while it starts to go beyond what I can absorb. It would just be too much because a lot of the solo

that you did on the saxophone sound was out of the key, which is terrific, but I just couldn't imitate that. Everything I would do would be very triadic and pretty lousy. And I ... One thing I've noticed over the years is that ... I had some discussions with the colleagues I work with, and one of my friends said that it's not that your fingers can't this and can't that. It's that you don't hear it. And the fact is ... I thought about it. It's like, he's right. When I think about ... Let me imagine a solo in my head. I don't hear it. You know, except whatever I'm playing, for the most part. I just don't hear it.

PP: That's interesting because I was reading a book by Henry Mancini, who wrote very famous melodies and worked as a jazz musician and he's written jazz pieces. He confessed in his book that he can't play jazz. He could never solo. He could play the chords and he was in many big bands ...

CC: Pretty much what I can do ... play the chords, and that's about it. Because that's the way I'm mostly hearing it ... just the chords.

PP: Yeah. He could never solo. Interesting. How much time would you allow ... Let's say we had a Bach chorale. It was 32 measures. How much time would you allow for that ... to memorize it and to play it perfectly? How long would that take you?

CC: Let's see. How long would that take me? 32 measures. You mean memorize ... For me memorizing would mean I would never need the music again. See, I don't know I could do it all in one sitting. Not meaning ... It's not the amount of time because I think it also has to happen repeatedly over the course of a few days. But I would say, generously speaking, if I wanted to not embarrass myself, between two and three hours. And then hopefully I wouldn't need it anymore. But then, if I did it all at once ... here's the thing. I'd have to make sure I played it every day for a while, and then I'd really start owning it ... I could hum it on my own. And I could imagine myself moving the notes when I'm thinking sometimes. I'll imagine what

my hands are doing. When I dream about myself playing at night and stuff, and I hear music, I'm thinking the notes ... naming them and ... the way I would when I'm awake. My fingers are moving, except I'm sleeping. So I see myself moving my fingers. Or at least I consciously think that whatever brain triggers I have to send to fingers, I think those through in my dream also. But I'd have to do it over time ... just repeatedly.

PP: And let's say ... Let's say it's a Monday and you're memorizing a piece and you're going to play in on Friday night someplace. Would you find the need to refresh yourself frequently over the week?

CC: Yeah, definitely. Because what will happen is ... I might actually have it memorized by the end of Monday night and then play it several times. But then Tuesday morning, I'll get maybe only 80 percent of it. And some of the really intricate things, I might have forgotten. And then I'll have to refresh my memory. And then I'll put it aside again. And then Wednesday, the same thing, but on a lesser scale. By Friday it will probably be with me. So it's not only just to do it all at once because I could probably do that, but by virtue if I just played it a thousand times, of course I'd probably be able to play it. But now the next morning is the real question. What do you really remember after time goes by? And that's why after usually the third of fourth time, now it starts to really become permanently part of me.

PP: How often right now do you perform from memory?

CC: Yeah, always. In fact, all the concerts I've given for my first three years, I've never used the music. I kind of pride myself on that. I never wanted to. I always want to just do what I'm gonna do. Because some of them are long arrangements and stuff like that. So with my kids at school, I've always made it a point to try to do the best I could without the music, and I've been successful so far.

PP: What kinds ... Give me examples of some pieces that you've done.

CC: Broadway tunes, things like that. A lot of this stuff, again, is my accompaniment ... which I like the flexibility of being able to do that. Um. Occasionally, it will be something I don't want to play ... really from memory ... that's specific on the page. I've done a Randall Thompson piece or two where I want his accompaniment because it's a lot better than anything anyone else could do. And so I want the real thing. So it depends on the piece. Most times ... [can't understand word] recording that they have and some of the stuff ... you know, I could do a lot better, so I don't need their accompaniment.

PP: I hear that you're intimating something about the element of confidence. I'm sensing something there. Do you find that, when I gave you the example of learning a piece on a Monday and having to perform it on a Friday, that it's truly ... um ... forgetting things, or is it more you're just not sure if you can do it?

CC: Neither. I would say it's more being nervous at the time to ... You know, now this is what you waited for. The big moment to get to do it, and that would be a little unnerving to me, more than anything else.

PP: Your ability to memorize. Does it matter what style the music is?

CC: Not particularly. No.

PP: Baroque. Classical. It would be the same to you. Modern-like could be a little bit more ...

CC: Definitely. In that regard, yeah.

PP: Now the same problem you would have with the modern piece would be similar or dissimilar to a jazz piece?

CC: Identical, as far as the solo lines would go. The difference in the modern piece is I wouldn't hear any chords at all, so I wouldn't even know where to begin with it. It just would make no sense.

PP: Harmonically or melodically?

CC: Both. Just musically in any way. You know.

PP: But what about a jazz piece that's fairly normal in its progression?

CC: I could do the chords, probably, really well, and the main melody. But when it came to solos, you can just leave me out because I just wouldn't get it. I wouldn't be able to ... I'd hear and enjoy it when someone else is doing it, but I couldn't hear it myself.

PP: But your ability to ...

CC: To reproduce it would be ...

PP: To reproduce it. Even though you say, ok, he's descending in a line that has a modal feel to it.

CC: See, I wouldn't think of modal. I don't even know what that would be in terms of a solo.

PP: Ok.

831 CC: But, yeah. It's true. And that's part of the problem.

PP: Ok. I'm talking with CP. Carmine, give me a little bit of your background, just so I can get a handle on it.

CP: Music?

PP: Yeah, musically.

CP: Musically, let's see. I went to West Babylon High School ... played in the band there ... drums. Then went to Queens College ... got my degree there. Then played on cruise ships for a while. Went on the road for two years. And basically always writing music. That's my main thing. Then started teaching in Bellport ... '83 to '87. Left. Went to study composition in L.A. Then went to teach in Brazil for three years. Then went to Alabama for my master's for two years. Then went to Singapore for four years. [laughs] Then we came back to Bellport. Unbelievable.

PP: The circle continues.

CP: Yeah.

PP: When you went on the road, who ...

CP: Oh, just a club band ... Bold and Brassy, it was called. By then I had it with school. [laughs] You know that, right?

PP: Absolutely. Ah, I just wanted to talk to you a little bit about your musical memory, and how you utilize it. If you're going to memorize something, can you tell me about the process you might follow.

CP: Yeah, a lot of repetition. Usually with me, if I have to memorize a tune and I have the music, I'll play through it with the music a lot, and then I'll try to do small sections of it by memory ... until it's pretty much all memorized. You know, but I'm talking about tunes ... not concertos or anything.

PP: Yeah, no, that's ok. So you're talking about pop, jazz ...

CP: Jazz standards ... when I used to play.

PP: Right.

CP: Yeah, the tunes.

PP: So when you say sections, how big are the sections that you might attempt at one time?

CP: Probably like 16 bars ... you know, the phrase of the tune, usually.

PP: Ok. When you're looking at a tune, do you focus on ... What element of music do you focus on first?

CP: Melody.

PP: Melody first. So you would memorize 16 bars of a melody and the other 16 of the bridge, whatever is coming next.

CP: Right.

PP: That's probably the process.

CP: Yeah.

PP: How important is the harmonic aspect to your memorization process?

CP: Uh, when I'm doing the melody ... not really too much. I'll glance at it and stuff like that, but mainly I focus just on the melody. But, you know, just seeing the chords there, you start to look at it ... Probably, harmony second. But, you know, I don't know if my memory is that good because even tunes I write ... you know ... Somebody could ask me what key it's in. I wouldn't know. Even published and stuff ... If I don't play them, I don't remember them, really. I don't remember the chord changes. [laughs] I'm not kidding. I am serious.

PP: I actually ... I hate to admit this, but I'm the same way. Even pieces I've written.

CP: Yeah, you get it out of your head, you know. I think if you do a lot of writing, you're like that. If somebody's wrote like one tune, they'll know that tune. But I think most writers get it out. Even my friends ... Someone will say, what's the changes? I don't know.

PP: That's wild. Um. Now you're talking about primarily the saxophone right now.

CP: Yeah.

PP: You're not talking percussion at all?

CP: No. Percussion ... Percussion's always a little different. There wasn't really too much memorizing ... you know ... playing jazz, drums, whatever.

PP: Which saxophone ...

CP: Alto.

PP: Alto.

CP: I hold now.

PP: The others were probably getting too heavy. [laughs] Ok. So if you had to think of the order of the elements of music, you would start with melody, and how would you ...

CP: Definitely melody first. Um. Well, the way I usually write is melody. Then I figure out the harmonies. I always try to like do the writing away from the keyboard ... you know in my car. Because the thing is ... Really melody is the purest then. Because it's real melody ... like great folk tunes. Why do they go on forever? Because people, you know ... it's perfect melodies. Then harmony ... basic harmony. Then I use a keyboard. And then usually I'm writing so there's always like the orchestration arranging always going at the same time. Yeah. Like I don't do just the lead sheet ... I usually go right to score.

PP: Right. And what types of compositions do you write now?

CP: A lot of concert band and jazz ensemble.

PP: Ok. All right. So now I had a good question for you about the harmonic aspect ... Ok. You said you write melody pretty much without a keyboard.

CP: Yeah.

PP: Harmony's the same way?

CP: No. Well ... basic harmonies I can usually hear, but no, most times I use ... Not to harmonize each note. Just the basic harmony, I use the keyboard ... you know, basic chords. Not like harmonization of each note. I don't do that.

PP: How often do you need to check your melodies against the piano to see how accurate you've been? Or do you find yourself being accurate all the time?

CP: Well, it depends on how involved it is. If it's simple melody, I'm pretty good. Up to probably medium hard. If it starts getting really notey and chromatic, then I got to ... you know, I check it out. But most of the time, I'm always thinking ... like the intervals and stuff like that. So I'm pretty close. Sometimes I'm off ... you know.

PP: In the jazz pieces, especially, articulation is important. Where does that fall in your memorization?

CP: Um. As far as when I score it and stuff, I always do that last. I always do the melody, bass line ... You know, after the harmony is bass line. Then I do the harmonization. Then the articulations always come last. But as far as hearing them ... I guess as soon as you do the melody.

PP: Right.

CP: Yeah.

PP: That's what I was kind of getting at.

CP: Yeah, it definitely goes immediately.

PP: So the articulations are pretty much with the melody?

CP: Yeah.

PP: In the early stage. Um. Do you still gig at all on sax?

CP: No, I don't play. You know, I play with the kids ... [muffled]

PP: Do you have pieces that you have still in memory, let's say, from years ago?

CP: Oh, yeah.

PP: Do they give you a rough time?

CP: Melodies. No. I know them. I never forget them. Even the first tune I wrote. I remember that. And even tunes I never ... you know, I would think about writing ... they come back, too. But other ones I do forget ... totally forget. Like, my friend and I used to write a ton of stuff, and then sometimes we'd get together for a laugh ... because we used to record them. And we would say ... I forgot ... I totally forgot about that song. Yeah, things like that would go out.

PP: That's cool. What do you find jars your memory when you do recall these pieces?

CP: The melodies. And I can even remember from the actual recording of them ... I can remember things that happened at the session. With my friend ... things like that. And there's like an ongoing joke where he insists on his Flat 5, to which I said no. And we put it in ... and, you know, we listened. He's like, I'll told you. So his thing is always ... How about a Flat 5? No. [laughs] Do you know Bob Mathews? I don't know if you know him.

PP: No, I don't.

CP: Yeah, he's a keyboarder. He plays a lot of the shows around ... stuff.

PP: Does he?

CP: Yeah, he's in Cold Spring Harbor. He does classical music. Yeah, he does The Stage. You know that place ... The Stage? Don't they do shows?

PP: Yes. You can give me his number later when we're done with this because I'm always looking for someone.

CP: Yeah, so is he cause he wants to do it sometimes ... sometimes he wants somebody, you know. He's a good guy.

PP: I'll tell you later about what I'm doing.

CP: Yeah, I could remind you then. I know the number.

PP: How does interpretation fit in with all this ... in terms of ... Well, let's say you've written a concert band piece. Do you do it for this level ... elementary?

CP: Yeah, all levels.

PP: All levels. Do you ever get to conduct them?

CP: Yeah. That one I did ... The Dinosaur one. Were you in there for that?

PP: Yeah, that was cute.

CP: I did that, yeah.

PP: Um. That's memorized ... Is it?

CP: Ah, you see, not really. I don't ... let me see. You know what governs that a lot is the range of the trumpets. So it's probably ... I don't know. I don't even know what key it's in. Probably ... I'm thinking C Minor [muffled]. Probably is. Yeah. I don't know. I'd have to look it up. I'm a retard. [laughing] I can't believe it. I'm serious. You know, with this level, a lot is the range.

PP: Right, I'm sure. All right, when you're remembering pieces like the jazz ... I know we're hopping back and forth, but ...

CP: Yeah, no, that's fine.

PP: But that's the way my brain works too. Does anything else jar your memory besides melody? Like if you try to think of a tune but you can't remember the melody, what would be the next thing that might jar that out of you?

CP: Oh, probably harmony. Because sometimes if I listen to a jazz group ... anybody's jazz piece ... you hear the harmony, you know what tune it is. So probably that. But my own tunes ... If I ... I mean, I don't know if I'd forget a melody of my tune. I don't think so. I know I sing them wrong sometimes, according to my wife. It doesn't go that way. But I don't think I would forget. I'm not sure. You know, once I get going with it ...

PP: Right. When you're memorizing a tune, how long would it take you to memorize like an average bebop thing or some standard for someplace ...

CP: A standard tune ...

PP: It's something new, now. You've never heard it. It's a new standard.

CP: Oh, I've never heard it.

PP: Chick Corea just wrote it ...

CP: Now, the shape I'm in as far as a player ... Probably a little while. I would say maybe a couple of weeks if it's really involved. Unless I really start practicing, you know. I might remember it in my head, but as far as trying to memorize and play it ...

PP: Ok. Well, let's talk about that first before we get into the playing. That's an interesting way to look at it. If you saw this piece, how long would it take you to be able to write a lead sheet out for it? To memorize the piece.

CP: It's a brand new piece ...

PP: Brand new piece. 32 bar.

CP: Yeah. After looking at it, right? Studying it?

PP: Yeah. And you can have it for as long as you want. How long do you think? Just a "guesstimate."

CP: That's interesting. Maybe three weeks or something. It depends if there's money involved. [laughing].

PP: Yeah, I always do things a lot quicker when ...

CP: Yeah, that's interesting though. I don't know, not playing it, if I'd be able to ... even sitting at a piano ... just listening to it and then seeing the lead sheet ...

PP: Would it be quicker, do you think, if you played it?

CP: Yeah, it might. But if I knew it well enough, then I could probably ... if I knew the key ... without even seeing it ... then I might be able to just do it by ... even if I did slow like ... to do do [he's humming] ... you know, like that. I might be able to ... maybe a week if I had to really do it. You know, it's funny you should say that because I was thinking ... We did a talent show here and they did ... the teachers had to get involved. I better not go on the air and say what I want to say about that. But I had to memorize some tune ... like from Cabaret ... Welcome?

PP: Willkommen?

CP: Yeah, and I hadn't done it in a long time. I had to practice a little bit. So about a week because I had to play it without the music. Without the horn ... I don't know. It's a hard question. I don't know. I would have to try it. If it's really intricate, maybe it would take me a while.

PP: Right.

CP: But to actually memorize it up here ... I don't know, it might not take me that long, you know, if I listened to it.

PP: Well, thinking of ... you're now playing the horn. Does the kinesthetic have any ... Does that offer any assistance to you in the memorization?

CP: Yeah, it does a lot. You mean feeling it, right ... the horn.

PP: Yeah, tell me about what you might go through.

CP: Well, there are some things, like, I could hear when I used to memorize the Charlie Parker thing ... Charlie Parker and all that stuff ... and from the horn ... like, I know what he's doing. Is that what you mean, like?

PP: Yeah. Exactly.

CP: Well, of course there's a few things he always plays. I don't know if you have the Omni book.

PP: No.

CP: Yeah, well, you see how many times he repeated himself. But there's a few things ... like I know exactly ... I could play them easy because I know the feel. Certain things ... [hums a little] ... I know that right there.

PP: You know what he's doing. You can almost feel his fingers in yours ... doing what he's playing.

CP: Yeah, exactly. And also, when I do write down ... sometimes at the keyboard ... Sometimes I will find myself ... doing the horn a little bit. Yeah, that I can feel. Not as good as some people. I know some people can ... You know, whatever they can hear, they can play.

PP: Um. If you're memorizing a piece and there's some kind of distraction ... Let's say you were memorizing this 32-bar new piece by Chick Corea. Tell me about getting back on track. What would you have to do?

CP: If I had to stop?

PP: If you had to stop and take a 10 or 15 minute break because something happened ... the phone rang.

CP: Am I playing now, or just ...

PP: You're playing.

CP: I'll probably have to look at it and play through it again.

PP: Play. Start from the top? Or could you start ... If you already think you've memorized the A section, how accurate would you be in a 10-minute interval?

CP: If I already memorized it? Probably good. Yeah. That's another thing I forgot to tell you. I also start in different spots when I memorize something. I don't always start at the beginning. And that's what I tell the kids, too, when they have their solos. Like when I memorize something, sometimes I start at the bridge or the odd chorus. Otherwise, then I can't memorize it.

PP: Really?

CP: Yeah, if I always just start going from the beginning ... I think I have to break it down into smaller chunks and then put it all together. Yeah, that I forgot. I used to do that a lot.

PP: Tell me why.

CP: I used to think if I got ... When I was doing club dates, if I got lost or something, I could pick it up again.

PP: Oh, that's interesting.

CP: Yeah. That I remember. Always trying to be like ... pick it up in different spots, but always at the beginning of a section, not like in the middle or something. Yeah, because I thought ... you know ... I should know the tunes. You know, going on a club date, if you make a mistake you'll never get hired again. [laughs] But that I remember ... yeah, breaking it down smaller and starting from different sections. But now ... I don't know how long it would take me to memorize something, or the old tunes, if I could still just, you know, play. Especially the Bach things.

PP: Oh, yeah. The Bach things are very hard ...

CP: Very hard just to play.

PP: Well, they're hard to play and they're hard to memorize because of the ...

CP: Actually I do know. I don't remember some of them a lot. Because when I was playing for this talent show, I actually practiced a little bit. And I would try to play some of the things I thought I knew, and I can't play them anymore. You know, I would have to go over them. Um. [mumbles some song titles] All those things, you know ... Actually I could ... I don't know if I ever could. [laughs]

PP: It's funny.

CP: Yeah, it is.

PP: When you compose, and when you're thinking about your compositions in retrospect, do you find you're a linear writer or a harmonic writer?

CP: Linear. Definitely. And I try not to ... In fact, you ever hear of the Grove School in California? Dick Grove ... I went to him for a year, because it was a year program.

And his whole thing was writing away from the keyboard ... because in L.A. those guys have to turn it out. You can't sit there like ... You know, you have a thing ... a melody ... you have to harmonize for saxophone. You just sit there and you just do it. And that's what the whole training was for. So, I'm definitely more linear. And then I would do the harmony.

PP: Yeah, I find I could write that way in pop or jazz, but I can't do that if I'm writing ... Like, I'm writing a concert band piece right now. And I have to sit at the piano because I have to ...

CP: Play it out.

PP: Yeah, I have to play it out.

CP: Yeah. I always do a melody first.

PP: Yeah, so do I. But I still have to ... I still want to check it. I don't trust myself.

CP: No. I know what you mean. Well, with the computer music, though, you hear the things played back. It's unbelievable. You know, that's new to me. I only got into it about five or six years ago. Up until then, I never heard the piece until the band played it or a group played it. And the whole thing in L.A. with Dick Grove ... You got the assignment. It took two days for you to write it. You had to write a lot in two days. In those days ... copying all the parts out by hand. And usually ... I think it was on Tuesday morning, a professional group would record it. And if you messed up, you know, Dick Grove would be there or the conducting coach, and he heard about. The whole thing was ... You know, I thought I was going to be like one of those writers in L.A., and I went out there and found out everybody could write ... and good. You know. But that was his whole thing, you know. You get it right on paper. Studio time costs too much money. But now with the MIDI and stuff, you would hear if there's

wrong notes. It changes the whole thing. It really does. It used to take me forever to write a chart. And when I went there and used his whole process, um, I could get an assignment one night and have it done the next day. And it would work. It might not be the greatest thing. That's what his whole thing was. It doesn't have to be the next great American symphony, right. But it would work. So, I write, I guess, more like that because of him. It's good training. But now with the computer, you futz around more. You know, it plays back like a band ... you know, with the right instruments. It's fun.

PP: Yeah, it is. I can't wait to finish somewhat of the piece so I can do exactly that ... hear it.

CP: Are you going to write it for your band at school?

PP: No, it's too difficult.

CP: Oh.

PP: I figure at least I can hear it on the computer. You know. I have to get these ideas out. I've been sitting on them for too long.

CP: Yeah.

PP: I had a couple of questions about performing from memory. How often ... You don't do that that often anymore?

CP: No.

PP: But in the past, how often did you perform from memory?

CP: Every weekend. I used to do the club dates.

PP: You were a club date musician, right?

CP: Yeah. I'm trying to think. One thing about memorizing ... I had to do it really quick one time. I joined the road band, and I didn't know when I joined that I was going to be in the front three. I'm not that type of person. I only had to memorize steps, which is so embarrassing. But the whole show ... a two-hour show.

PP: Wow.

CP: And then I did ... sat hours and I got the whole show in about two weeks. You know, not real hard stuff, but I had to ... That's when I was really ... and that was with the horn, playing it over and over. Because it wasn't tunes. It was actual arrangements.

PP: I can't imagine doing steps.

CP: No. It's embarrassing.

PP: When we were talking about memory before, we talked about doing things in sections. Memorizing different styles would be approached the same way? Or perhaps differently.

CP: No, I think the same way. Pretty much. All melody ... you know, it doesn't matter what the style is ... unless it atonal or something. But I don't really have any ... like Off the Wall. That's a good question. How would somebody memorize some of that? Atonal music, you know.

PP: That's true. The process would definitely be different.

CP: There's no tonal sound. If it's real atonal music.

PP: Right.

CP: That ... I have no idea. That would really be by music ... I guess until you learned enough where it was a melody.

PP: I guess eventually it would get there. Because going over and over something, even though it's atonal, you kind of catch a melodic contour of some kind.

CP: Yeah, and I guess it depends who wrote it. [can't make out the names] They all had different styles. Some were more melodic. Schoenberg ... I don't know. I never liked that stuff anyway.

PP: Me neither, Carmine. Great. I think that's pretty much it.

CP: Oh, that didn't hurt.

PP: Okay, I'm talking with DB. Today is July 6, 1998. Des, what steps, what processes do you take? How do you go about it?

DB: The most common way is to just listen to it. If I have a keyboard or a guitar handy I just work out the chords, uh, just like hearing it and trying to play it by ear. Um, if there's any, um, defining characteristics like a repeating line, outside of the melody, like a little guitar riff, or something like that, I'll take special note of that. If I think it's, uh, a fairly simple song, I'll do it completely by memory. If it seems like it's a little complex, I'll starting writing a few notes and chords down, ideally with lyrics if I have them written down, too. And then, um, I put it aside for awhile and come back to it to see how much I've remembered and then just add to my memory what pieces I'm having trouble with and if I have to go back and listen to it again, that's fine, until I feel like I can play it all the way through. And it pretty much stays there.

PP: Mmm. Okay, so basically you're more of an aural kind of learner. You listen and

DB: Yes, listen and play it.

PP: copy and go over it. Now you mentioned if it's a short song, it's relatively easy to memorize ...

DB: Yeah, if it's a folk song or you know, a simple rock song with just three or four chords or something like that, I'll probably just, you know, commit it completely to memory and not have any kind of paper involved at all.

PP: What would happen if it's more involved? Would the process be different or?

DB: Yeah, I would probably be listening a lot closer. Um, if, like I mentioned, if it's a folk song, and the arrangement basically just has to be singing and strumming, then just about any kind of strumming or any loose arrangement would be find, but if it's a complicated piece where it's important to emulate some of the arrangement in the recording, then I'll be listening very closely to specific instruments. In my situation, um, especially if I'm just going to put a guitar accompaniment, I'd be listening to all the instruments and seeing even if it wasn't originally for the guitar, but there's a defining little musical piece, I'll see if I can somehow work it into a finger picking situation or something like that and I'll be listening a lot more closely to behind music, if you will, behind like, again I'm talking strictly popular music, behind the melody and the obvious harmonies, I'll be looking for little tiny colorations in the background that might be nice to bring out on a guitar arrangement.

PP: Do you find it easy to memorize?

DB: Um, it's a good question, um, I've just always done it that way. I don't, I find it easier to memorize than to read a score, however, I can read a fake book with chords, and I think, obviously, that's the easiest. You see the lyrics and the chords in front of you and you just have to follow along, um, I have alot, I can't really read manuscript music very well, uh, I'm very poor on that, so um, obviously I think anything is easier than that.

PP: A lot of people mention to me that they like to visualize the music, like if they're reading it, they're able to bring it back to their mind. Now you, as an aural player, and using your memory, is there some correlation you could bring in with that?

DB: Lyrically, that's a very fair statement. If I'm going to be singing the song, I will sometimes picture scenes if it's a story type of a song, I would try and picture the scene or if it's not that clear, let's just say it's a love song about a guy and a girl,

I might, for some reason, make up a scene and in this particular song I'd visualize the couple under a tree with the sun setting or something like that. Those types of things will trigger some memories of lyrics. As far as just the music end of it, um, yeah, sometimes I'll visualize a band playing. I'll give you one example. Um, we were talking before about if I wanted to play a little riff on the guitar that I think is important, uh, to the song, I might visualize a piano player that's just about to step in and play this line and then that will trigger my memory to actually play it on the guitar. Something like that, those little tricks like that I'll use.

PP: Um, how do you go about measuring that you've been successful at memory, like how do you know, "I did it!" What's your criteria?

DB: If I'm working at a restaurant, say, and the guy pays me, I figure I did okay. If he says "I don't want to see you again." I probably didn't succeed.

PP: How about, just as a judgment for yourself, though?

DB: If it felt very comfortable. If I felt that I didn't have to work too hard at it, it sorta came easy, then I did a good job memorizing it. If I feel like I'm thinking too hard and not, um, if I'm being very mechanical in my performance because I'm concentrating very hard to try to remember something, then I feel I'm not, I'm not entertaining as much, I'm technically getting through the music but I'm not being the best entertainer I can because I'm concentrating too hard on trying to remember things. Excuse me, that's my computer. It whistles at me once in a while. If I find that I can smile alot and connect with a person while I'm performing and can add a lot more entertaining aspects to the performance, then I must have done a good job memorizing the music and the lyrics because otherwise I'd be thinking of those things.

PP: When you're memorizing a piece of music, what kinds of distractions would interrupt the process more than others?

DB: If nobody's home and the phone is ringing, I have a hard time just letting the phone ring. Kids running around screaming and yelling is always a bad one and a constant one. That's why I do my best memorizing late at night after they're asleep, so try to work on stuff. Are you talking about in the privacy of my home, trying to memorize?

PP: Yeah, let me explain what some other people said. With other people from the study, we were talking about different types of sounds. Now you mention the kids running around and the phone ringing really disturbs you alot. With other people we were talking about the difference between, for instance, a radio playing in the background or music on the radio, or speaking on the radio. Say if there was a radio playing and it was someone speaking, would that bother you just as much, not so much, or less than music playing.

DB: Less than music playing. If someone is just speaking it bothers me less than mus... if I'm studying music.

PP: Uh-hum.

DB: Um, I am one of those people, um, would have to really push it in the background. I mean, it can be on, but I can't even have a half an ear on it, like if an interesting news story, and I catch a couple of words that are interesting, that's it. I'm just, I can't not listen to it. So that would be an interruption there to, but certainly, um, music on while I'm trying to memorize a different piece of music, is a great distraction. That's, uh, very difficult. Um, if I had to, if for some reason I was forced to be in a room where this was happening and it was important that I have to memorize this music, I, I, suppose I could do it, but not very successfully.

PP: When you're memorizing a piece of music, and that TV show with the words that attracted you come on, is it easy for you to get back to what you're doing?

DB: No. No, I mean, I have to sort of like regroup, "okay, where was I?".

PP: So if you learn the head to a song and then were interrupted, let's say you learned the whole song, let's say you started memorizing, and you were pretty much getting it, and then you got distracted by a news story and you were working, let's say, the chorus, bridge, when you got interrupted, would you have been able to just to the bridge, or would you have to go back to the top?

DB: Yeah, I probably, it's more like if I was interrupted within a section, I'd have to go back to the beginning of that section. Ah, I couldn't go to the middle of the section, but yeah, if it had clearly defined pieces like a verse and a chorus, I wouldn't have to necessarily go back to a verse and a chorus to be learning the bridge, but I'd certainly, if I'd had gotten most of the way through the bridge, most likely I'd have to start at the beginning of the bridge again.

PP: Okay.

DB: And just to get myself into it, if I had the time, I'd probably go back to the verse and the chorus just to make sure, "well, as long as I was interrupted, let me just see if I have what I thought I had," and just quickly go through the verse and the chorus.

PP: Alright. Some of the other people I had interviewed were more, like classical musicians, and we talked about the elements of music, like notes, dynamics, articulations, which in popular music maybe you can skirt a little bit, but if you had to think of, let's say there was a song with a lot of different dynamics and maybe tempo changes and things, what order would you try and memorize that

in? If it all?]

DB: Just the dynamic portion?

PP: No, the whole ...

DB: The whole song?

PP: The whole song. Let's talk about melody, chords, dynamics, let's say there's tempo changes.

DB: Yeah, um, I think melody is probably the most important thing. I'd want to get that down. Depending on the song, sometimes just the chords alone are just as important, the rough chords, and sometimes they're neck and neck. Sometimes, one isn't necessarily more important than the other. But once I got that down, especially if I'm scoring something, if I'm putting together the bass lines, and the keyboard parts, and all that other stuff, I think the next thing would be the rhythm. But not necessarily tempo changes yet. So, for example, if I was sequencing and I might start then working on the bass and the drums, that kind of stuff, um. Only after I got the rough basic chords, basic melody, basic rhythm, then I would start, uh, looking at tempo changes and dynamics, and some other coloration instruments in the background, and stuff like that. Nine out of ten times that would be the order that I would approach something like that.

PP: Uh-hmm. Good. Um, this maybe unfair to ask you this but, how many pieces can you perform successfully from memory?

DB: Hmm. Probably a lot less than I did a few years ago because I started getting lazy. I don't think it's a function of I couldn't do it, I just, the jobs I go on now, I have the luxury of being able to bring fake books with me, um, my

own version of fake books, so uh, and there's thousands of songs in there. Um, I would say if I had to, I could put together a show of 200 songs by memory, because I probably had most of those songs memorized. I just don't know off the top of my head if I really have them memorized or not, because of this lazy streak I've developed.

PP: In your kind of work that you do now, you mentioned that you mostly play, like, popular things. Do you do other styles as well?

DB: Umm

PP: Let's subdivide the popular into other things, like folk, folk rock, hard rock, whatever.

DB: Yeah, our main source of gigs are anything that, when we say popular we don't necessarily mean what the billboard charts would call "pop". If there was a popular show tune, if there was a popular R&B number, if there was a popular folk song, or a country-western song, popular in any of those sub-categories, we consider the whole thing "popular". To us, popular means the people, maybe the audience we're playing to, would probably know it.

PP: Gotcha. Interesting. Uh, the methods of memorization that you use then would be the same for each of those styles? You wouldn't treat one differently than another, from what you described to me before?

DB: I would say the only thing that might be a little different from what I described so far, would be blues and jazz instrumentals. That's more of an improvisational thing I do, so I don't think that would necessarily follow exactly the rules that we just kind of talked about. Um,

PP: How would the process be different for a jazz tune?

DB: Um, depending on the kind of, well let's just say blues, because that probably fits what I'm about to say that would be easiest. Um, the structure is, um, is the most important thing. Like what is the progression of chords for the basic lead, and that's it. I don't memorize anything else. Other than that, I kind of, at that point on, except for the melody of singing it, everything on the guitar, whether I sometimes strum or sometimes pick out a tune, or finger-pick, or actually do a solo, all that stuff is improvised just about everytime, and it's different each time and that adds a little bit of excitement and edge to the performance, too.

PP: If you had a gig, let's say August lst, and you had to put on a kind of show and they requested tunes that you weren't familiar with, how much time would you need to get, let's say, half a dozen specials songs together?

DB: I would say, on the average, a month. Uh, and that would include uh well, actually I should probably clarify that a little. (volume decreased and it became inaudible) ... it would also include in my situation, sequencing all the background tracks, and getting my female singing partner up to speed on whatever part she'd need to, whether she had to sing the lead or be the harmony or whatever on these tunes, um, arranging it with her so there would be a combination of memorizing the arrangement and pre-recording certain things. So about a month

PP: Okay. Let's exclude all those, suppose there was just a, uh,

DB: I'd just have to walk in and sing it maybe?

PP: Yeah. Just you, guitar and voice, let's say?

DB: Half a dozen songs? Uh, if they were of the simple variety, (became inaudible and blank for a minute or so) maybe half that time.

PP: And you mentioned we were talking about how easy it was for you to memorize before, I think your response was "Okay, but not like it was in the past."

DB: Oh, um,

PP: Clarify that for me.

DB: I think, I think you've got it on tape, so you can tell me if I'm wrong.

PP: I'll check.

DB: I think the first time you asked me, is how easy is it to memorize and I said I wasn't really sure, since I can't compare it to reading the score, cause I don't do that very well, which is obviously easier than that.

PP: Okay.

DB: But then you asked me how many songs did I know off the top of my head, and I said, in that respect, I've become lazy at memorizing songs, so,

PP: Okay, then let me qualify the question. Um, okay, as far as memorization goes, okay, let's just talk about memorization for a second. What, you mentioned your process that you go through, which element of the process gives you the hardest time? Like, what's the biggest obstacle for you for memorization?

DB: Probably learning um, I love jazz, but it's not my forte, I mean I love jazz and I can play a decent amount of it, but I would nowhere, never consider myself a jazz player. I couldn't just go up to a jazz chair and say, "Hey, can I sit it?" I could never do that.

PP: Okay.

DB: But as far as, I think my roots are definitely folk, folk music, uh, I grew up listening to Pete Seeger and that kind of stuff and generally speaking, it's the story, and the nice simple melodies and harmonies that are the most important thing, and the chords, you know, you have a handful of chords, three to five chords, you know, so, um, that's what I grew up with, that's what I, and that same philosophy carries through to simple rock and roll and all that stuff. But when it gets a little more than that, I love it, but I have a difficult time, and it's just what, cause I wasn't really brought up on that. I had an appreciation for that stuff a lot later in life. It wasn't a part of my developmental years.

PP: Okay, so out of all the different styles that you do perform, probably jazz would be the most difficult for you to

DB: For me, yeah.

PP: to memorize.

DB: And classical.

PP: Classical, yeah. How often do you currently perform from memory? Even just a song or two at a gig?

DB: Well, I perform, uh, you know, it's hard to say cause we have this book like I said with hundreds of songs and I'm not really sure how often I look to it. Sometimes I look at it when I don't need to, you know, like "I think this is the next verse coming up?" but I just double check and knew it was right, so, does that count that I have this memorized still?

PP: Yes, because you didn't really,

DB: I didn't need to look at it?

PP: you didn't read the material that was there, you really had it.

DB: I'd say that uh you know, I perform about anywhere from two to four times a week, four-hour gig, and I would say that maybe half of that gig, so two hours worth of music, anywhere from two to four nights a week is probably memorized. If you include some of that double-checking as a

PP: Yeah, oh yeah, I do the same thing. I can't, I don't trust my own memory sometimes. How would you rate your being successful at memorization? Those times that you did memorize, on a scale of one to ten, how successful were you?

DB: Well, as far as having to do, say, a single performance of a newly memorized song, uh, I've been very successful. Um, as far as being able to recall that song a month later, on the spot, without any preparation, uh, 50-50.

PP: It's actually a pretty good ratio. Um, is there certain types of music that you would find yourself more successful at than others? I'm

just curious about that, because you talked about the jazz thing being difficult for you, but folk would probably be the easiest. If you, maybe if you thought of different styles, I mean

DB: Well, obviously, um, the easier the song, the less I have to memorize, the more fun I can be as an entertainer, so that kind of goes half and half. But even things like I mentioned, things like I've mentioned, learning jazz later in life, uh, I've only been singing like Sinatra tunes for example, that's something like you know, I'm 43 now, and I never really started even attempting to sing Sinatra until I was in my very late 30's. Um, always was a good appreciator of him, I never disliked him, just never, ever, even thought of doing it, and then as I started doing more gigs, which is also something I started late in life, I found the need to do it and found out that I loved it. So, I find it difficult, in a sense, that, yes, I didn't grow up with it, and it's not something that intuitive, but when I do do it, I get a tremendous amount of enjoyment from it. What was the last question?

PP: I don't know. I'm glad I have my notes here. Uh, how would you rate your being successful at memorization?

DB: Oh, success, yeah, I think I misinterpreted, I started talking about what I enjoy memorizing, but okay, successful? Um, I'm relatively successful. Yeah,

PP: You feel confident that something you memorized by Wednesday, and it's gonna be a Friday gig, you feel, I mean, when someone says "Do you know this tune?" You say, "Sure do." And you feel pretty confident.

DB: Well, see, that really isn't my goal right now. My goal is that by Friday I'll perform it well. And I will have cheat notes with me. So, have I learned it enough that with the cheat notes, if I need 'em, very successful. If I absolutely could not have the cheat notes with me, um, it's hard to measure cause I don't really do that that often anymore, but I would say what I used to do that, I was fairly successful. I think the reason I have the cheat notes is because I have this deep down suspicion that I probably wouldn't be as successful now if I did that.

PP: Well that brings up, I'm glad you mentioned that, because that brings up the next question. How important is confidence in your ability to memorize?

DB: In my ability to memorize? I don't know if I think about confidence in the memorization process. I do think of confidence in the entertaining process.

PP: Oh, that was the next question.

DB: Yeah.

PP: So we could talk about both at the same time.

DB: Absolutely, extremely important, in the area of being able to perform well, um, I think that possibly, with the exception of a recording artist, who can have everything in front of them, and do take and re-take, and everything like that, um you must have a very high level of confidence to lay down any kind of performance other than recording.

PP: What would make you shaky about it, about the memorization of a song? I mean what

DB: The memorization?

PP: Would confidence be a key factor in that?

DB: The complexity of the number would certainly be a factor. If I saw something that uh, was rather complex and it was the kind of music I don't normally do, um, that would certainly make me very less confident and nervous about doing something before I even got into it. Although, it's interesting there have been times where, um, we may have been hired to do a wedding, for example, and there's a month to go and they decided they just heard this song they must have as their first song, and they've changed all the plans, and we say, "Oh my God, we're never gonna pull this one off," and it surprises me. So all these factors that get me nervous up front, sometimes they're not known.

PP: Right. Um, some of the pieces, if I asked you now to play, I mean, let's say three or four songs that you definitely have memorized. What would the titles be?

DB: Oh probably something that I, I can't help but play on every single blooming gig I have to go to and sing. Uh, "Under The Boardwalk", uh, "Margueritaville", um, "I've Got You Under My Skin", just about any popular Beatle number, that's stuff that we just play all the time and that's the reason

PP: And those you don't cheat on those. Those are just the

DB: I don't think I do. I mean, I have the stuff there available, but uh, I don't think I do.

PP: I do the same thing. I keep my fake book open, but I find myself not looking at it.

DB: Right.

PP: It's just like a little blanket, a security blanket, kind of thing.

DB: Tell ya, I mean, obviously, the ones that you just always do are the ones they keep getting refreshed and burned in harder and harder and so those would be
DB: the ones I would do.

PP: Okay, the piece that you just named, in your estimation, how difficult are those?

DB: Very easy.

PP: Very easy. Okay, now you've been a performer for how long? How long have you been doing this?

DB: Uh, professionally, and by that I just define doing it on a regular basis and getting paid for it, very very recently. Only about three or four years.

PP: Oh.

DB: But occasionally doing it, um, sitting in with a band and you know, all the way back to my high school days. I've always been involved somewhat in it, or as something I'm going to get around to doing one of these days for money, and uh, finally decided to do it.

PP: Do you find tiredness impacts your ability to memorize? a

DB: Yeah. Oh yeah. Tiredness impacts my ability to do anything, except sleep.

PP: I think that's it. Oh, what type of audiences do you perform for currently?

DB: All types, but uh I don't think there's any one particular audience that we wouldn't have performed for except for maybe a you know, a classical audience, a real classical concert, we wouldn't do that. Let me just rephrase the question and see if that would help you out. I think our favorite audience to play for is a very mixed crowd. Um, because I personally can get very bored with the same type of music for four hours, so if there's a mixed crowd, young, old, urban, rural, um, different ethnic diversities, uh, that kind of stuff, then I'm entertained, too, cause I can mix it up. So as long as I'm entertained, I feel that if I'm happy, I'm exuding a little bit of happiness, too.

PP: The types of places that you perform in are, you don't do, like, concerts and stuff? Do you do libraries and things like that?

DB: Very little, very little. We have done some of that stuff, um, we did. The last successful one we did was with a big live band. We went, we did it uh, a concert for the Bellport Village, we did a Beatles Tribute a couple of years ago, one of the summer concerts there, and that was a lot of fun.

PP: Oh, by the water down there?

DB: Yeah. It happened to rain, so we did it in the Community. But that was a lot of fun. Very successful. Very very enjoyable. Um, but no, it's not in concert form it's usually society parties, restaurants,

PP: Do you do a lot of private parties?

DB: A lot of private parties.

PP: Okay, thank you.

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481 DB: You're welcome.

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483 PP: Let's look one more time. Yep, I think we've got 'em all. Good. Thank you.

Interview with ED

PP: Ok. Today is October 26, 2000, and I'm gonna call you ED. Just briefly, give me your educational background.

ED: Ok. After high school, I graduated college and got a bachelor's degree in music-vocal performance.

PP: Ok. Have you been studying since with anyone?

ED: After college, I studied with a voice teacher in Manhattan and I studied for about six years consistently ... like on a weekly basis ... with a voice teacher and also three years with a vocal coach in Manhattan.

PP: And tell me a little bit about what you've been doing professionally in the last year or so?

ED: Um. Mostly solo concert work. I did a Bach cantata with the Suffolk Community College. I did a concert version of Cosi fan tutte out in East Hampton with the East End Chamber Orchestra. I did a solo performance at the Parish Art Museum in Southampton in a program I called American Dreamers. It was to coincide with their art exhibit that they had. And so I put together a concert of dream songs ... anything that had to do with dreams. And there was so much material to choose from, so that was exciting to put it together. And of course the idea was just American composers. So that was good. And, um, prior to that again I have another concert that I pull out every so often called Songs Your Heart Knows, which is a combination of arias ... you know, operatic arias ... and then music from the Broadway genre. So that's what I've been doing professionally.

PP: Have you done any acting since ...

ED: I haven't done acting in about ... no musicals here on the Island ... for three or four years.

PP: Oh, Ok. All right. Now basically the questions I have that I'm going to ask you are about how you utilize your memory ... your musical memory, especially, although any kind of memory that you'd like to talk about is fine. Um. When you go about to memorize a piece of music, can you tell me a little bit about the process ... the initial stage process that you ...

ED: Now, first I usually tear the piece apart rhythmically ... I do rhythms first ... time signatures ... learn the rhythms, clap them out ... whatever I have to do. Then I go back and I play it on the piano ... the melody line. I play that out and then I do it by myself to make sure that I've got the rhythm and the tone right ... the melody right. And then I go back and go over the words, and I fit the words in. And then of course last would be the translations, if there are any translations. You know, I sit there with a dictionary and tear it apart that way. And also ... even American pieces too ... come to think of it ... If I'm doing something in English as well, you know, I sit there and think what the composer's trying to convey ... give it thought that way. That's how I tear it apart. It's usually rhythmically, melodically and then the words.

PP: Ok. As far as your memorization, how much of the piece would you take at a time? Would you do it in sections .... break it up in any way?

ED: Let's see. I guess I take it apart ... Well, if it's a long piece ... Like the Bach cantata took me a while to do, but I took that apart by sections, you know, because that was easy to do. I just took the first part, second part and third part, and those are several pages each. So if it's something long like that, I'll spend a week on one part ... you know, if I have that kind of time. I had months to prepare for that one, so I really took my time with that. But, um, I guess for shorter songs, I memorize ... If it's an ABA form, I guess I go for the melody first, and then the bridge. I do it in order as it's written.

PP: Now because you have skills as a pianist also, do you worry yourself a lot with the harmonic structure of the pieces, or ...

ED: I do look at it ... I definitely try to play the accompaniment to see what's going on underneath. That's really important to hear. This way it's no surprise when you get together with whoever's gonna do the accompaniment.

PP: Right. Do you ever record yourself on the piano, and then sing with your own recording, or ...

ED: I've never done that. To date I haven't. If I get the opportunity after I've done my usual process of memorizing, and I get the opportunity to find a recording, then I'll listen to something. But I like to learn it first. This way I know I've got all the notes down right, instead of depending on a sound.

PP: Right. Now judging your own success, do you ever ... You have recordings of like your work that you listen to?

ED: I have recordings, yeah.

PP: Do you critically listen to them afterwards and ...

ED: Yes. I did a competition called Savannah on Stage two years ago, and I was a finalist in that. And they recorded every step of the way ... the quarterfinals, the semis and the finals. And I tore it apart. I listened to it and thought, gee, I could have done this, I could have done that. That's a big part of being able to go on and get better. It's very difficult to do.

PP: Tell me a little bit about what you're looking for.

ED: Tonality, pitch ... Was there feeling? You know, when you're listening to something, it's different than when you're watching it. So I think recording is very difficult. I found going into a studio and making a recording, which I did last year ... That was a very difficult process because it's one thing for people to see you, and they can watch

your face and see the emotion. But when they can't see you when you're doing it in the studio, it really has to be almost over the top ... for me.

PP: When you're memorizing a piece of music ... I'm just curious ... If you're distracted or if you take a break ... Let's talk about the Bach cantata, and you said it was in three sections. Let's say you were in the middle of memorizing that first section and you decide to take a lunch break or whatever, and you came back. Where would you go back to?

ED: The top of the piece.

PP: The top of the piece. Ok. You wouldn't like ...

ED: Take it in the middle?

PP: If you were at measure 24, you wouldn't go back to 24. You would go back to 1.

ED: Right. Working on the piece, I guess I wouldn't ... I would probably try to find the most difficult passage and work that first, but I wouldn't go back to that. No. I'd probably go back to the beginning. I like to be orderly.

PP: I know what you mean. How long does something remain in your memory? Like you learned this Bach cantata for what performance? How long ago was that?

ED: It was last Christmas, and I could probably sing it tomorrow.

PP: Ok.

ED: It stays with me.

PP: It stays with you for a while. Good. When you're memorizing a piece of music, you mentioned that you look at the different elements of music and that you start with

melody most likely. Can you tell me about the other elements of music, and how they're incorporated in the memory process, and if there's an order, what order might they be put in?

ED: Like the accompaniment?

PP: Um ... articulation, dynamics, form, whatever other elements that you would be concerned with in the performance aspect. Some people do it all at once. Some people say, no, I do this first and then I do that, and then I do the other. What's your approach?

ED: Ok. I learn the melody first. I put all of the extra work ... I guess I notice that afterwards. I look at what the composer's put down as far as dynamics, and the pianos and the fortes and all that. That's definitely a second ... you know, that's after learning the melody. You know, looking at the markings is after.

PP: Ok. When you're memorizing, how important is the visual aspect of it?

ED: Oh, this is the most important thing, I think, because I actually memorize or keep in my mind what the notes look like on the page. I visualize the page. I learned this in college, and it's been a great help. I'll be standing in church with maybe an exceptionally long passage, and I'll think of what it looks like on the page. It's definitely visual for me. I do learn, you know, the meaning of a piece ... what it's saying ... but a big part of it is the picture in my mind on the page of what it looks like.

PP: That's great. So you can see the page?

ED: I can see it. I can see all the pages. I can see the numbers at the top of the page ... page 2, page 3, page 4 ...

PP: You can? So if I picked a passage in the Bach cantata and sang you the passage, you would be able to visualize ...

ED: Which page ... At least which section it came out of.

PP: That's cool. How about the auditory? How much ... Some people ... like I have a friend ...

ED: By listening, you mean?

PP: Yeah, I have a friend who doesn't really read that well, and he'll get every recording defined of an aria or something, and learn it that way.

ED: That's always a help to me as far as the accompaniment goes, and what's happening underneath me. But I don't like to listen to other people's interpretations or other people's ... As far as memorizing goes, I like to do it on my own. Like I said, it just makes ... I can make sure that I've learned all the notes correctly that way. It's just a matter of running it then. If I find a recording, maybe I'll sing with it ... just to hear, like the accompaniment.

PP: But you wouldn't memorize ...

ED: I don't use it to memorize by. No.

PP: Ok. Great. Do you sing in various styles of music?

ED: Yes.

PP: What styles are you comfortable in?

ED: I've done classical, Broadway style ... I've even done some jazz lately that's been successful for me.

PP: Great. When you've had to memorize in those various styles, do you use the same strategies that you use in classical?

ED: Ah, yeah. I think so. I can picture the music on the page. I do attack everything the same way ... rhythm first, then the melody, then words.

PP: How much time do you need to memorize something? Like, for instance, how much time did you need to memorize the whole Bach cantata that you ...

ED: I knew I had a couple of months to work on that, but I think I had the whole thing down in a couple of weeks.

PP: Ok. Good. Overall, do you find it easy to memorize, or difficult?

ED: I find it difficult.

PP: Ok. What ...

ED: I labor over it.

PP: Ok. What aspects of it are uncomfortable or ...

ED: Mostly if it's a foreign piece ... you know, in a different language. I labor over the translations and the meaning. It's always much more difficult to work on something operatic for me. That always gives me a little bit of anxiety. It's much easier to memorize in English.

PP: Ok. How often right now are you performing from memory?

ED: Um, maybe ... Well, I guess weekly.

PP: Oh, weekly. Ok. And your success rate at being fairly critical ... not overly critical ... not letting things pass ... How would you rate your success at memorization?

ED: You know what. I always get so anxious about it. I'm always concerned about words, and I go through a lot of worrying ahead of time ... right up until the time I have to get up and sing. And I guess I've been successful at it, even though every week I have to do it ... every week I get the same nerves. Every week I get the same anxiety ... the same thing comes.

PP: How important is the concept of confidence do you think in your ability to memorize?

ED: Well, I guess if I was a little bit more confident and realized that I do this often ... that maybe I wouldn't be so anxious. But I think that's just something I've been born with. I've always been a worrier. I've always been nervous. I've never gone through any performance without being nervous about what I know. And I guess if I had that extra confidence factor, it might help.

PP: Well, I think everyone I've spoken to has shared your same feeling, so ... And I know I feel that way also. How about the confidence in your ability to perform what you've memorized?

ED: Performing is much more fun, though. I have to say ... There is that certain moment like diving off a diving board, where you're out there, and you've jumped, and you can't do anything about it. And so you're in it .... I have more confidence with performing because I guess I've actually made up words in other languages too. I've been in a spot where I've realized I've come up to a passage where I didn't know what I was supposed to say and I completely forgot what I was saying, and I've actually made up words. So, it's a do or die situation, and I go through with it, and I make up words if I have to.

PP: Excellent. What type of audiences do you find yourself performing for?

ED: Um. Here on Long Island it's been mostly 55 and over. Most of my concerts sold out. It was great. The one at the Parish Art Museum was completely sold out. 160 seats they had ... and I'm a no name ... you know, basically. I don't have CDs out or anything. But I think the type of music that I do ... when I do my own concerts ... like the Songs Your Heart Knows program and this American Dreamers program I did ... it attracts an older crowd, which is a little bit ... You know, I'd like to see younger people come, but ...

PP: That's pretty much it.

ED: Really? Ok.

PP: Fairly painless, right?

ED: It wasn't difficult.

Interview with LE

PP: Ok. I'll be speaking with LE. I'm going to ask you some questions concerning your musical memory. Keep in mind that there are no right or wrong answers. I would like to see if there is some pattern that will develop between the various subjects. Now, Lauren, when you go about memorizing a piece of music, what steps or processes do you use?... How do you go about it?

LE: I play the whole song through several times and then break it down into separate sections ... always going back to play the whole thing through.

PP: Ok. And you're talking about piano right now?

LE: Yes.

PP: Ok. Do you ever separate the hands and do the same thing?

LE: Yes, depending on the level of difficulty.

PP: Ok. So if I were to hand you a piece of music now, explain what you would do. Suppose it were relatively difficult. What would be your first step?

LE: I would probably start with the right hand ... usually the melody, just to know how the song goes. I'd try playing through as many times as I could. Then I'd go to the left hand to get a feel of that. Then I'd play them separate several times until I was comfortable. I'd try to put them together and then I'd break it down into sections, playing them together until it went smoothly.

PP: Ok. How long would it take you, do you think, to memorize an average piece with that format?

LE: Um. During lessons, it would take me probably a week to get the songs and then a week or two to memorize it.

PP: OK. How do you know or measure that you've been successful at memorizing a piece of music? How do you judge how good you've been or how successful?

LE: When you just put your hands down and you play and you never really think about it. Your hands kind of just play it.

PP: Ah. So you use kind of a kinesthetic ... in other words, how the keys feel playing a certain chord or a run or something ... you're looking at patterns, or you're feeling patterns, rather than thinking notes ...

LE: Yeah.

PP: That's good. So you would ... I originally asked you how you would measure that you've been successful at memory. What's your criteria for saying, wow, that went really well. How do you know if something memorized went really well.

LE: If the piece is played smoothly and there's no breaks in between, and I don't have to hesitate and think about it.

PP: Ok. How concerned are you about things like dynamics and articulation and all that other stuff ... besides the notes? I know you'd be concerned ... Like you just mentioned when you hear a song being played smoothly, you know that you've played it correctly, but the notes are just one part of it. Do you worry about the other parts when you're performing?

LE: I'd usually consider that after I knew the music, which often it causes you to forget that there are dynamics. But I think it's easier to know the music and then the fine detail of it.

PP: Ok. What happens if you are interrupted or distracted when you're memorizing a piece of music? How do you get back on track?

LE: Distracted for a moment or for a long period of time?

PP: Let's say just distracted for a short period of time. Someone comes in the room and says, hey, Lauren, how are you doing? And then, ... oh, man, I was in the middle of memorizing this section. What would you do to ...

LE: I would just clear my memory again and start from the beginning.

PP: Ok. And that's the question. Would you start from the beginning or start where you left off?

LE: If I was memorizing a certain section, I would start from the beginning of that section.

PP: Ok. Now if you've memorized a piece of music and you're playing it, and you get distracted, what kinds of strategies would you employ to get back on track for that?

LE: I may go back a few notes, or just pick up ... try to remember where I left off and pick up there.

PP: Do you find it easy to go back where you left off, or do you find it easier to go back to the beginning?

LE: I usually try to pick up where I left off. If you can't remember, or it's too frustrating, then I'd go back to the beginning.

PP: How easy is that for you to do?

LE: Relatively easy, if I know the music.

PP: What types of distractions do you encounter that bother you most while you're playing ... performing a piano piece?

LE: Um. Outside distractions generally don't bother me. I just ignore it. Things that would mess me up might be if my fingers were tired or something, and I keep missing the same notes. That would interrupt me.

PP: Ok. Um. Different distractions ... let's say ... Let's talk about distractions just for a second. Um. Some distractions might be verbal ... you know, someone in the house yelling for you to come here or whatever. How does that compare with aural distractions ... like more musical distractions ... like a TV playing or a radio playing or a CD playing or something? Do you find one type harder to ... or more of a distraction than another?

LE: Yeah. If music was playing, it would be a big distraction ... because I always have to think about what's playing. If I know the music, I'm always going along in my head, so I couldn't play with any music or TV in the background ... anything like that. If someone was calling me, that's different.

PP: Ok. Thinking of the elements of music, is there an order that you memorize things in? In other words, there's articulation, dynamics, notes, phrasing ... all these types of things. You explained it kind of before, but I just want to make sure I understand. When you're memorizing a piece of music, what would be the order of things that you would memorize?

LE: First I would memorize each hand ... the notes on each hand first. And then together, and then things like dynamics.

PP: Ok. So those would be added in after you felt secure with the notes.

LE: Yeah.

PP: Ok. How many pieces do you think you could perform successfully from memory?

LE: It's been a little while. Um. Notes of considerable length ... maybe two or three.

PP: Ok. Do you play different styles of music ... on the piano?

LE: Yeah. I would use lesson books, which try to mix up the styles ... and then separate pieces by choice.

PP: Ok. And the methods that you use for memorization ... Would they be the same for each style of music? In other words, if you had a piece by Mozart and then there was this little, maybe popular kind of song, or whatever, would your style of memorization be the same for both?

LE: Yes, generally.

PP: Ok. How much time do you allow for memorization? For instance, if I told you that we need to perform a short piano piece by July 1, how much time would you think you would need to perform, let's say, an average, short ... like a Mozart ... short piano study? How much time do you think you'd need?

LE: I would use all the time from now. I would get started right away to make sure that I knew piece. And to memorize it ... I couldn't really put a time frame on how long it would take me. I wouldn't know.

PP: Ok. Do you find it easy to memorize?

LE: For me, it's easier to memorize a piece than to read the music.

PP: Oh. Explain that.

LE: Um. Just trying to read the notes and find the notes on the piano ... I find more difficult than just getting it in my head and playing it.

PP: Ok.

LE: Cause I think sometimes when I'm reading the notes, I have to look down at where the notes are a lot. I have to watch my hands. But if I know the piece, it's easier.

PP: Ok. So you seem to favor ... once you know the piece, that you're hands are just going to go where they belong ... and there's no more thinking involved ... or not a lot of thinking. What about the process of memorization is most difficult for you? What about the whole process troubles you, or makes it difficult?

LE: Maybe if the piece changes styles a lot and there's a lot to remember. Or if it's really long, but it's not, you know, repetitive.

PP: Ok. So ... like different sections. So if a piece has maybe four or five sections, it would be much more difficult than having one section. Do you perform from memory at all now ... for any reason?

LE: A little. If I just sit down ... I'm passing the piano.

PP: And how would you rate your being successful at your memorization? In other words, let's say you've learned four or five pieces a few months ago and you were passing a piano. How successful would you be at just doing it off the cuff now?

LE: Um. Pretty successful. I've played a couple of times and it usually comes back to me. I haven't played a piece for a year, I'd say, and I forgot about the piece. And then I brought out the music and remembered it, and within like five times of trying, it came back.

PP: Ok. So your long-term memory is pretty intact for music. Now just getting off the subject for a minute ... Is your memorization equally as good for your academic work now? Do you find it easier to memorize a piece of music, rather than some dates or some information for history?

LE: I'd say that they're equal. It's usually what I like, I tend to remember more. I could remember something from middle school, if it were interesting to me, just as well.

PP: How important to you is confidence in your ability to memorize? Or explain how confidence is a factor.

LE: Well, because I prefer to memorize, I'm confident that I can memorize. And so that is the way I go about it. So, confidence is important.

PP: How important is confidence in your ability to perform the pieces you've memorized?

LE: Even more important, I'd say. If you're playing for someone, you have to be confident that ... You know, I wouldn't want to play a piece for someone if it weren't to a level of perfection that I'd like it to be at. So you have to be pretty confident in how you think you'll perform it.

PP: Ok. Can you tell me the titles and composers of some pieces that you know ... or have tried to memorize ... even if you weren't successful at them? Just so I have an idea of ...

LE: Um. Many of them were just from a practice book, so I don't know what level they're at. "The Piano Man," by Billy Joel, I played that. But my teacher rewrote it so I don't know if it was at the same level of difficulty. And "Dangerous Journey," that I always play. I don't know who it's by. And a piece by ... it's a mix of work by Bach, Beethoven and Brahms.

PP: Ok. You mean different works by them in a book?

LE: Yeah ... into one song.

PP: Oh, into one song?

LE: Yeah. Well, just three pieces kind of smushed together.

PP: Oh. Ok. How difficult in your estimation were those types of pieces? Like, for instance, in this and many others, there's levels from one through six. Just an estimate ... if you have any idea of knowing.

LE: I didn't play the piano ... I mean I didn't take lessons for very long, so it wouldn't be of much difficulty.

PP: Ok. And have you ever performed from memory in public for any reason ... like at a piano recital or ...

LE: Yeah. I performed for three contests ... two, I believe, of which were by memory.

PP: Now, where were they?

LE: In Queens. For the Long Island Music Teachers Association. It was more of a festival than a contest ... It was a personal contest.

PP: How often have you done that? Just the three times?

LE: Three times. I did it once a year that I took lessons.

PP: How long ago was that?

LE: I stopped taking lessons two years ago.

PP: What types of audiences were there when you performed?

LE: One ... maybe two people in the room. Three max.

PP: Oh, Ok. So a small group. But they are musicians, or are they students?

LE: Music teachers, I think.

PP: Music teachers. Ok. And do you continue to perform now?

LE: No.

PP: Thank you, Lauren.

LE: You're welcome.

PP: Ok. Lauren what piece is this?

LE: "Dangerous Journey."

PP: "Dangerous Journey." Ok. Play a little bit for me.

[Lauren plays "Dangerous Journey."]

LE: I don't really remember it.

PP: Ok. Thank you.

Appendix-B Subject Interviews
Interview with AB

PP: Could you just tell me briefly about your education ... your background.

AB: Well, I start piano when I was 2. Actually that was my picture when I was 4 of the very first solo recital that I gave. That wasn't the recital itself. That was the publicity picture taken in my house. I remember they took a picture ... at my piano. From the age of 4, I gave one solo recital a year. Because I was very good, my mother didn't make me go to school ... which was a big mistake. But anyhow, I always had tutors in my house through 12th grade. And at the end of the year, I would have to go to take the tests ... which was very difficult, too, because the schools don't like to ... don't like to ...

PP: Have people outside ...

AB: Yeah, they try to make it very hard for you. It was very hard. But anyhow ... other than that was the fact that I had to practice two hours a day until I was six, I believe. Four hours a day until I was 9. Six hours a day until I was 12. And 8 hours a day since the age of 12. It was really, really hard. Also, because my mother was ... I don't know. I can't figure out my mother. I love her very much ... we had a tremendously difficult relationship ... tremendously difficult relationship. I adore her. She never told me she loved me her whole entire life. In March in the year she died ... 1986 ... I told her ... We had a fight, and I said in the fight, "you might die first, I might die first ... but whenever that happens, I know that you will not have ever told me that you love me or that you are proud of me." Well, if I'm a mother and I have two children ... If one of my children would tell me that, I would make a point in doing something about it. She didn't do anything. She died that December 3. She never told me she loved me. She never told me she was proud of me. She died in 1986 and I miss her a lot, but I haven't been able to cry yet. The only thing is that every year she came here in December ... the Saturday before Christmas ... because ... she had a big school of music and she finished school ... They study in March. So she would come here the Saturday before Christmas and would go back at the end of February. And almost every year ... for many years ... every time around Christmas when we

are putting the house and cookies and I start crying because I miss having her here. But I haven't even been able to miss her death ... to cry her death ... because she never let me have a friend. I had to study ... and I never went to school. I was never allowed to have a friend. So I had what sort of life ... So I finished ... You were asking me about my education. I finished the high school. I went to music school ... No ... First I went to Paris and I studied at the Paris Conservatory. Then we came back and meanwhile I finished my high school. I went to university music in Argentina and I got a bachelor's, master's and Ph.D.

PP: All from the same university?

AB: No, the first two from one and other one from the Catholic University ... Buenos Aires. Then we got married and we came here. And we went to live in Missouri with a scholarship from Washington University. So I got a second master's degree there because I really wanted to have it from this country. I think it's very important if you live ... especially if you are a citizen of a country, which we became as soon as we were able to. I adore this country. But then we moved to New York. And I said, well, it's very nice, but New York doesn't really care for a degree from St. Louis. You know, I better get a degree in New York. So I went to study in New York... We actually got a full scholarship. He got a teaching assistantship, and I got a grant, both Yale and Stony Brook. We went to see first the two schools. And Yale was wonderful ... I know it has a tremendous name. But the buildings overwhelm me. I cannot live in that atmosphere. I have never been very good in Europe. This type of building ... I need the modern things ... I can't explain why. It's just a feeling that I don't like. So I said to my husband, I can't come here. There's no way I can live in these buildings. So we went to study in Stony Brook. Got the second master's degree. And then I was teaching in Princeton. One day I realized that of all the piano faculty ... I was the only one with a doctoral degree who was not .... not an instructor, but the one after ... on the scale, very low. I was making like $11,000 a year. I was seeing in money $700 a month, for which I had to go four times a week from here to Princeton and back. You know, the gas, the tolls ... I mean, it was ridiculous. I wasn't making any money. So ... and everybody else was making much

more ... at least $20,000, which was nothing, but at least $20,000. They were professors, blah, blah, associate professors ... So one day I went to talk to the dean, and I said to the dean, I'm a person who has always to understand things. When I went to Paris, and I was 14, at that time the teacher ... they called that maître ... and the maître was like God, and whatever he said, you did. And you never, ever, ever question why. I questioned him all the time. And everybody went, uh, you can't do that. I said, but I can't do it just because he says so. I have to understand why I'm doing something. Otherwise ... I'm just doing what he says. It's his brain working ... not mine, you know. If I don't know why I'm doing it, then the next time when the same thing happens I still don't know what to do, you know. Just to see how much I need to know ... to understand things. So I went to see the dean, and I said I would like you to explain to me why I'm the only one with such a ridiculous salary and so low on the scale, when I'm the only one who has the Ph.D. So he says, well, because your Ph.D. is from Argentina. I said, ok, if you want one from this country ... you're gonna get one from this country.

Can I explain to you this story, because it's really important, and it's not in the book ... So he said, well, if you're going to get a doctoral degree from this country it has to be Juilliard. So I go to Juilliard and I ask for the applications. The woman ... the administration ... The woman in charge of the administration looked at me and she says, how old are you? I said I'm 37. She said, no, you can't come because we expect you to leave here with a doctoral degree by the age of 29, 30 ... not to come at the age of 37. I said, but you know, I had this operation ... for 17 years, I couldn't play. She said, I don't care and we don't want to set a precedent here. Well, I felt ... I went home ... came home ... didn't do anything. A whole year went by. The year after I said to myself, there's nothing I want more than to go to Juilliard. Why can't I go to Juilliard? So I went back the next year. The woman sees me. She says, weren't you here last year? I said, yes. She says, do you have a problem with comprehension because I told you that you were too old. You are not younger this year. You're older than last year. So I left again. Another year went by. A lot of people were telling me that I could sue or something Juilliard because they were discriminating my age and the whole thing. But you don't sue Juilliard because you'll never play again. So I let

it go. Another year went by, and very often I'm on television and radio. They ask me to go to talk about (???). So when I was doing a radio show, and at the very, very end, the man who was the host says to me, well we have 30 seconds if you want to say something else. We were on the air, you know. And I said, well, what I want to say ... If only one person of everybody who heard this program ... after the program will go and say, well, I always wanted to do this ... I'm going to go and do it now. You know, I will be happy that I came all the way here. I should say that. My husband had gone ahead of me to get the car in the garage, and I'm going down after that in the elevator on my own. And I said, am I stupid or what? I keep on telling people, go and do things, go and do things. I want to go to Juilliard more than anything in the world. What am I doing here? You know. So I go to Juilliard again. Well this woman, she says I can't believe it. I just can't believe that you're here again. Well. When you are born in another country ... from which you are dealing... One of the good things is that when you want to ... You play dumb because you were born in another country, therefore you don't know. And I use that when I can ... when I need to. So I put on my most stupid face, and I said, you know, I know you have told me that already twice, but I have taken that book you have, and I have gone back and forth and back and forth. I cannot find the place where it says that you do not accept people over the age of 26 or 27 because they have to be out by the age of 30. She went like this ... she went white. And she said, oh, no, we can't print that. She said that before she thought. You know. Well, we can't print that. And I knew why she was saying that. But again, I was playing stupid. You know. Really. Why can't you print that? And then ... like she just woke up or something ... Oh, my God, she said. I know ... Because that's against the law of the United States, right? Isn't it in this country you cannot discriminate age? Well, she said to me ... Give me a few days. I'm going to talk to someone. I left. I said, well, this is it. Ten days later I get a whole new application. Now, at that time, they got the applications from all over the world. You just have to send all your background. They will select the best 12 applications, and the whole piano faculty will see the 12 and take 2, so it was a very difficult ... So I sent the application, and by February they will let you know if you made it or not ... because the auditions were in May. I never heard again from them. People who I know ... they told me they already heard. No, no, yes, whatever.

I said, okay, that's it. In May, a week before the auditions, I got a letter in the mail. So I'm looking through the mail and I see The Juilliard School. I still remember the day. I opened the letter and it said that I was one of the 12 finalists. They should have sent it to me in February. They didn't tell me on purpose, so I would not be ready.

PP: Oh.

AB: They gave me nine days ... when the other people had three months to prepare. And I wasn't prepared because ... That was a Wednesday. At the very end it says, "be prepared to play as if you are 39 years old, because you will be charged as such." Like, you know ... not like you are 20-something. Well ... I must have practiced 28 hours a day. I was terrified. My teacher, who is my best friend ... he's my very best friend in the world ... I went to study with him. I never had a lesson with him where we can't have fun. But, I mean, he's a big name at Juilliard. He kept on saying to me, please don't, please don't play, please don't play ... because you're not going to make it. And everybody's going to say, see, she plays here, she plays there, but she can't even make Juilliard. He says, please. I said, look, let me see. I have to do how I feel. I went and I played. That was the only time in my life that when I was playing, my knees were going like this, and my teeth were going like this. I was so scared. I finished playing. I left. My friend, Matt Buchanan called me that night and he said, you were the very, very best. He called me the next morning ... No ... He says I'll call you tomorrow because there were six people playing Thursday and six people playing Friday. He said, I'll call you after tomorrow. So he called me again the next day and he said, I went to look at the numbers. You are the only one who has 80 and the next person has 20. And they take the first two. And he said, everybody gave you a 20 except (can't understand name) who gave you a zero. The maximum was 20. Everybody gave me 20, except for (???), who gave me a zero. And it said, next to the zero, "this doesn't reflect her playing but I think she's too old to come to this school and this is the only way I have to stop her." So I was the top, with the next one who was 28 points behind me, but they wouldn't let me in. So for six weeks, every Monday, the people from the doctoral ... whatever ... program will meet to

discuss me. And after six weeks, every Monday night, Matt Buchanan would call me and say they haven't reached a decision. And another Monday they haven't reached a decision. And they haven't reached a decision. And I was taking valium to sleep. On the sixth week, he called me and he said, Congratulations, you are a doctoral candidate. They have to take you. And they took me and I went to see ... and this is the end of the story, but I thought it was important you hear this. I went to talk to the dean to see what are the courses I was going to take ... (can't understand this part) ... And I walk into his office. I mean, I'm a woman who has children ... I'm an artist ... I don't clean the streets ... He didn't say hello, he didn't say good morning, he didn't say sit down ... he didn't say anything. As soon as they walked me in, he got up. He stood up for about 45-50 minutes ... screamed at me ... how upset he was that I had made it ... that he has done everything in his power to stop me from going ... that I was going to be so sorry to be sitting next to people who could be my children ... and that I was going make such a fool of myself. You have no idea ... for 45-50 minutes, he didn't stop screaming at me. I felt my face red like an apple. When he finished, all I said was that I was very, very sorry that he felt that way ... that to me it was extremely important to get a degree from Juilliard and the only thing I could do was to promise him that he would never be sorry that he let me in. I would never do anything to disgrace the school. As I was leaving he said to me ... You have seven years to complete the degree. If after seven years you don't complete it, you lose everything. And as I was walking out, he say, but I know that seven years will not be long enough for you ... meaning you'll never get it. Well, I walked out ... I was ... I went and cried. I walked out. My husband was there. He didn't know what happened. He just heard screaming for 45 minutes. The secretary didn't know what happened. I mean what happened? I was red like an apple. I went to the secretary and I said ... this was late July ... I said, when is graduation? And she said, it's the last Friday in May. And I said, how long does it take to get a doctoral degree? And she said, well, the minimum is two years, but nobody has done it in two years. The maximum is seven. I said, okay. So I came home, went to the calendar two years later. It was May 29 and it was my birthday. And I said to myself, I'm gonna give that degree to me as a present to me. You have no idea. I was teaching full time at Princeton. I was full-time student at Juilliard. I had constantly temperature. The

doctor was telling me that I was like a (???) ... I had temperature all the time because I was nonstop working, trying to do everything. But two years later I walked on the stage and he has to call my name ... because the dean is the one who calls the students up and get the degree. And I just looked at him. I said, seven years wasn't long enough for me. I got it in exactly two years, you know. But that's me ... or was me. I don't know if I would do that now. But that's how I got my second doctoral degree from Juilliard. It was very, very hard. I'm sorry it was long, but I thought you should know that story.

PP: No, that's great.

AB: Because it shows a lot of things ... just to give you an idea.

PP: Are there any recordings or things that I can get of you?

AB: I have here two CDs that I can give you, and also I might have ... I'm also gonna give you ... I think we have a press release that came out two years ago. It was the last concert I did at Carnegie Hall with my husband. When we first came to this country, we left my father, who was a millionaire ... his father was extremely wealthy. We come here and we starve to death. Because ... well, you read it. And when we will go out to try to find a job, we couldn't find anything. And once a day or so we would meet in front of Carnegie Hall because we knew how to get there. (I don't understand this part.) He said to me ... because he wanted to go back to Argentina. I said, you go. I'm not going. And so ... I kept on telling him, remember that now we here and starving. We don't have enough food to eat. For months and months, our lunch was a piece of chocolate. We would eat half each. And I would say, remember what I tell you. Now we are starving here, but one day you and I are going to ... (can't understand this part). And two years ago, we did it. We finally did it, and it was a huge success. I have a videotape of that so if you want to ...

PP: Do you? Oh, if I could borrow that ... Are you going to be at Carnegie Hall in February?

AB: February 11. I'll give you a flyer.

PP: Oh. Ok. Because I'd like to order tickets now so I can make sure I get in.

AB: I will get you tickets.

PP: Thank you.

AB: You just let me know how many you need, and I'll send it to you.

PP: Just me and my wife.

AB: Ok. Ok. But I'd like you to see that if you have a chance. Because that was really ... And you see me walking on the stage with a cane, and that was the beginning of going down. Because I wasn't too twisted yet ... too crooked yet. It got worse and worse. And last year ... last October ... I had scheduled a concert and it was canceled four weeks before. I couldn't even walk the stage with a cane. We lost like $30,000 because all these things that were paid for ... I had to pay. It was my responsibility. So I have this one now, and I hope I can do it.

PP: Oh, yeah. You can do it. Could you tell me a little bit, before I get into the regular questions ... These are the ones I picked up from the book. Could you tell me a little bit about the memory loss you mentioned that you had? My dissertation basically is on musical memory, so I'm just curious what types of memory losses you found in yourself after the accident.

AB: After the accident. You mean musically?

PP: Well, any kind. Whatever you'd like to share with me.

AB: Well, after the accident I couldn't remember anything. And one of the things the doctors would make me do is ... and I'm telling you this because I was told ... that they would give me food, for instance, and let me eat a few bites, and turn me around and say, which food were you eating? I didn't even remember that I was eating. They would be talking about something, and stop talking and say what were we talking about? No idea. When I slowly, slowly started playing again ... It took me 13 years ... When I eventually played something, the worst part was that I would stop anywhere playing and couldn't even remember if I was playing at all. Was I playing? What was I playing? Have I started the piece? Have I finished the piece? Was I playing at all? No recollection whatsoever. Sometimes I would be playing with the music, and if for some reason I would make a stop, I couldn't remember if I was playing ... It was very, very bad ... absolutely nothing. You know, nothing. What I have now ... what I have been able to get back, let's say ... I have always worked with many memories. I have a tremendous ear memory. So somehow you hear how the music goes. When I was young, I had a tremendous training, which very few people ... I'm more and more amazed when I see people that I consider my equals cannot do what I do. I don't know if you know, we say "do re me" in Europe, South America ... We say "do re me fa so la ti do" as opposed to ABC. I can tell you , because I was trained to learn that ... All the notes of any piece ... For instance, (she's singing a song) ... So that is something ... People can't do that. They do (she's humming) ... They don't know which note it is. When I was in Paris studying, my teacher made me learn to ... like have a photographic memory. And in order to push that or develop that, we start with very easy things, and after five years ... You're right. I have five hours lesson a day, seven days a week, 10 months a year. She will give me to start with one line or something, and I have to memorize in five minutes. And then she will give me a piece of paper ... music paper ... and I have to write what it was, but exactly. If it was an F, it has to be exactly what it was in the music. If it was that thing that's crescendo very louder, it has to start in the same place and start where I saw and end exactly ... like a photograph. You know. Not something that most people would do. Absolutely exact. And she developed my photographic memory ... so much so that when I play all my life ... even today ... when the music gets to the end of the page, here, in my mind as I'm playing I'm turning the page.

You know, because I'm following constantly where I am in the ... you know. Actually, when was it? This morning or yesterday at the school? I was playing a piece a little bit. I just starting to play again. It's two weeks. I haven't played for two years. So I have to try myself, you know. I was playing something which I have played from many different editions ... meaning that each edition has different places marked ... and I was saying to myself ... now I don't know where I am. Because I have nothing ... I am like empty here. I don't see anything because one book is here, another book is here, another book is here. So one of the things I learned as a child ... You always, always, always look at the very same piece, with the very same markings. So you see it in front of you when you play. So that has helped me a little bit, to come back. I'm talking about coming back. My technique uses a lot of muscles. I play with a lot of ... you know. So the memory of the muscles tells me to play. So it's the knowledge of the piece. It's the ear. It's the brain, of course. It's the looking at. It's the muscles. It's a lot of memories that bring back ...

PP: You try to use a more eclectic ...

AB: Absolutely. To help me. You know, I'm still very scared when I play. I'm very, very scared to lose it. But I'm trying as I'm performing to kind of get going all those memories at the same time. So if one of them gives up, somehow the others will make up for it and keep on going. But when you feel your brain going like this ... you know.

PP: Which do you prefer? Do you like the visual, the auditory, the kinesthetic?

AB: Visual. Because you have that feeling of seeing what you are doing. You know. It would be like if you have the music ... it's like you really have the music in front of you. Also, I've read many, many very good books when I was young. One of them teaches you ... Like if you say to me, don't forget when you pass downstairs to get the mail. As soon as you tell me that, I see myself passing the mail four or five times in my mind, and picking up the mail. So when I go there I actually remember that and I do it. And I don't forget. That's one of the things I learned as a child. All the

things help me. You know, I have a handicap but I have many things I use. Most people have a handicap and they say, well, I have a handicap. I'm gonna tell you one thing. One of the many things I had was breast cancer surgery ... seven years ago, October. I didn't play for three or four years after that. Because one of the things is that they cut me under here and they cut your nerves, so I don't feel this part. So when I play ... See, when you play, the muscles tell you how far you're going. I don't feel anything. I have to look to see where I'm going. So it took me three or four years again. Finally, I played. My oncologist is supposed to be the best woman oncologist in New York City for breast cancer, anyhow. So much so that they are doing a big thing for her at Carnegie Hall. She is two years younger than I ... a very nice lady. And when I did the concert after the operation three or four years later, she came to the concert. And a few days after the concert, I have ... I go twice a year ... I went to see her. And she told me she was amazed at how I could play. She said to me, here is your flyer, and she hands me a flyer. You have no idea how I've been using this flyer since your concert because I'm sick and tired of all these women who come to me and [she acts upset, like she's crying]. I tell them, this woman has exactly what you have. It's a matter of what you want to do with your life. I can't sit down and feel sorry for myself. I have plenty of reasons. A year ago, last February, I had a complete hysterectomy. This past March, I had a complete hip replacement. I mean, I have so many things in my life that I could really lie down in bed and wait to die, but that's not me. That's not me. I've been very lucky that before, all my teachers told me things that I can use now to make that pain work, and fill those holes they have there to keep on going and to ... I realize that all these things have helped me tremendously. Because if I were a normal person who has never had a lot of training or anything ...

PP: Do you have perfect pitch?

AB: Yes, I have. My mother used to tell me that when she was expecting me ... I was born ... I was the first child, and I was born four years after they got married. The nine months she knew I was pregnant, she prayed to God that I liked music because she was a wonderful piano teacher. My father was ill. He couldn't hear. He didn't

like music. He could hear anything ... she was terrified that I would be like my father. How I started learning at the age of 2 is because they used to tell me ... my mother and my father on a Sunday ... my father was reading the newspaper and I went to the piano ... I played, played, a lot of keys until I got to the middle C. My mother was teaching there so I was used to hearing people play the piano. So I got to the middle C and somehow ... Do you play the piano?

PP: Yes.

AB: Ok. So with wrong fingers I played the C major scale in contrary motion. With wrong fingers, of course. And my father, who didn't understand anything about music, asked my mother ... Why did she play so many notes, so many keys, before she started? And my mother thought, maybe she was looking for a middle C, but she was terrified. So she sent me far away, which was ridiculous because I couldn't see the keyboard and I didn't know the keyboard ... C, E, G, F sharp, B flat. You know, she would play two notes, three notes ... So she starts teaching me that way.

PP: Wow. Ok. Tell me about any kind of motor difficulties you had after the accident.

AB: Oh. Tremendous. Because I wanted to say use 1, 3, 5. I would use 4, 2, 3. Never what I want to. I felt very confused, like the brain was giving the order, but it was a place I don't hear ... where it will not go through. You know. So I could not bring down the finger I want to bring down. I want to bring down this one, but the other one would go down. And it took months and months for me to play. I could not bring down ... the biggest thing was to bring down the finger I want to bring down. Now, which scares me to death, once every six months or something, suddenly I'm playing at home or whatever, and suddenly I cannot do something, you know. After this operation ... I had a little concert in May ... that's the only one I gave. I'm starting playing again next Saturday, a week from tomorrow in Buffalo. And I was giving this concert, and one of the pieces I played was by Mendelssohn. And one place I couldn't do it. I was paralyzed.

PP: Your mind knows but ...

AB: But the mind couldn't give the order. You know, nobody knew ... when you're a professional, you cover up. And it was one measure. But I was terrified. Anything that reminds me of that time ... It's just going back in time, you know. That's tremendous.

PP: Any auditory?

AB: No, that hasn't been ...

PP: Visual?

AB: No. Well, I was blind, you know.

PP: Yes, I was reading that again last night.

AB: I was blind for five months. No, no, no. Not for five months. I was blind until they operate me.

PP: Right, but that was more psychological ... you implied in the book.

AB: Well, I had 15 blood clots that were pushing the brain and producing the blindness ... the paralysis ... and I couldn't use four of the five languages I knew, including my own ... I couldn't use Spanish at all.

PP: What other languages do you speak?

AB: Spanish, Italian, French, Portuguese and English. And I couldn't ... Spanish was gone. Gone.

PP: And that's your native tongue.

AB: My mother came from Argentina. First of all, she didn't recognize me at the hospital in Paris. She had to talk to me in French. The only language that came was French. It was very convenient since I was in France.

PP: Maybe that's why. Ok. Tell me about how you go about memorizing a piece of music that's new. Let's say you want to play a modern piece that someone down the road wrote ... Let's say it's a piece you've never picked up. They found a Beethoven ...

AB: Well, I have different ways. One way is I do a lot of rhythms. I change rhythms. Like I take a piece of music ... a page ... and I see the page as if I only see black ... like if there were just all black notes, with no rhythm. And I use 20 different rhythms, and I play the piece 20 different ways ... the page. And then I go to the next page and I do ... I try to do that 15 times, the 20 rhythms in each page. Usually after I do it five times I know it by memory ... the piece. However, by the same token, I am very ... like I do a map ... I do these two times and it goes up. Like, very intellectual, nothing with music. You know, I go twice here ... and then, I don't know, it reverses to here. And I get a map of the piece in my mind. You know. When it's hard to memorize, I really kind of learn the map of what I'm doing with my hands.

PP: Ok. Do you think of the elements of music when you memorize? In other words, do you start with something and work to something else? Or is it all, like ...

AB: Well, unless we talk about modern music again ... Because I practiced for 35 hours a week for 10 months a year for five years, by the time I left her, I knew all the pieces of piano by memory. One thing I remember is that she will be showing me the way. She will be showing me, so you learn 10 times faster. Also, when you have a teacher five hours a day next to you, you have no chances to learn anything wrong. As opposed to practicing for a whole week wrong and then going to the teacher. So by the time I left her I knew all the pieces. People don't believe me. I don't mean you,

but in general. People don't believe me. On the other hand, sometimes I'm in competitions ... you know, the judge in a competition ... intermission or whatever, you know when we have a break, we're having coffee or eating or whatever ... Suppose someone has played a piece and suddenly one of the judges says to another judge, that is your piece, right? You have learned that piece, right? And she says, yes, I play that piece. I say to myself, don't you play everything? What do you mean, that piece? If you're a pianist, you play everything, you know.

PP: Do you do any harmonic analysis while you're thinking ...

AB: Yeah, but not a lot. I mean, I know where I am ... harmonically ... but even this morning, I have a student who came for a coaching lesson. And she gave me the music, and I was looking. She wrote, A flat measure, E flat measure, whatever ... That has never helped me because I don't need to remember it's E flat measure. I cannot know it. Also, I'm thinking everything not in my mind. You know (she's humming fast) ... so I don't need to know. I don't need to think, you know ...

PP: Harmonically ...

AB: It's funny because I can solfege extremely fast.

PP: I noticed.

AB: There is the last movement of the funeral march finale that was very, very fast ... and I can do it. (she's humming fast). At one of the competitions, another judge ... a funny man ... he couldn't believe, you know. And every time they would take us out to dinner, he would make me do that for fun. And it was funny because several months later one of these musical magazines had a full article on the competition in Utah. It was probably five or six pages talking about the whole competition. And then they were talking about the judges, and then they said that there was this judge, you know, who can solfege faster than most people could play piano. It was cute.

PP: Oh, my. Do you play any other styles of music, or you're a classical pianist?

AB: Um, I love to play ... and I can play quite well, if I have the music in front of me. I'm not good at improvising.

PP: What kind of music?

AB: Jazz. I love it. But I can't improvise anything. I sat in so much training to follow exactly what's in the music, that I cannot play anything else. But I like it very much. I don't like rock 'n roll, and that stuff. Anything that has music inside, yes.

PP: That's great. Wow. We finished pretty much. You've covered all my questions. That's great. I don't think there's anything else, unless there's something from the book ...

Now, if I understood your book correctly, the accident was pretty much on the right side?

AB: It probably was on the right side. That is where I had the operation where they cut me. But I think ... I don't remember now. I think that the big thing was on the left, and that's why I couldn't use the right. I think it's the opposite ...

PP: Ok. Because I think you had ... it said the right side of the brain is the accident, but you had blood clots on the left side.

AB: Right, which provoked ...

PP: So that's why you had both sides having difficulty.

AB: Right, which provoked very much the right side not to ... The blindness was on the right side. The paralysis was on the right side.

PP: Ok. Now you had trouble speaking at first.

AB: Oh, yeah.

PP: Ok. And understanding conversation was a problem.

AB: Yeah, anything that has to think, you know.

PP: Right. Ok. I asked you about absolute pitch. And the auditory memory, you told me that's very good ...

AB: Yeah, yeah.

PP: Ok. I think that's it. I think we've covered everything.

AB: Do you have an e-mail?

PP: E-mail. Oh, sure.

AB: Because I could give you ... If you want to e-mail me something ...

PP: Oh, if I had another question or whatever. Sure.

AB: Right. Because I'm in the e-mail at least 10 times a day.

PP: Oh, yeah, I do too. I teach courses online.

AB: Oh, really. How wonderful. What do you teach?

Interview with CCT

PP: Just give me a little bit of your background in education.

CCT: Normal public school education. High school in Port Jefferson. I went to a school in Oxford, England for a time. It was there that I had my stroke. I am currently attending a university in Albany.

CCT: I went through one of my famous severe depressions ... took 50 tranquilizers ... wound up in a coma ... had to spend two weeks in a psychiatric hospital, and I'm now out on Medicaid. ... And I got married.

PP: You got married?

CCT: Yeah, and I'm regretting it.

CCT: So we got married, and I'm very unhappy with him. But I'm very forgiving. He knows that he was responsible for the fact that I overdosed. And he says that he's sorry for it. And I told him I'd move in with him, and I'm only bringing a trunk. So if I need to flee at midnight ...

PP: Ok. So you're gonna pretty much stay with him up near Skidmore and work. Ok. Just tell me a little bit about your trauma and what you experienced.

CCT: On July 16, 1995, I was in England and apparently I woke up that morning and I was feeling really, really cold, and went down to the kitchen to bake some scones. Never got that far because I ran back upstairs because I had a headache and started screaming. And my mom came up and I told her I couldn't feel my leg anymore. And that was the paralysis setting in. And then shortly after I went into a coma, and they brought me to the John Radcliffe Memorial Hospital in Oxford, and ran some angiograms, CAT scans, MRIs and stuff, and found that I had an arterial malformation which had ruptured into a brain hemorrhage, and did intrusive

surgery into my head within hours. And then I was in a coma for five or seven weeks.

PP: Do you know what part of the brain?

CCT: It was the right temporal lobe.

PP: And they cleaned it all out?

CCT: Basically, yeah. And I have a nice hole in there now. So my MRIs are pretty cool.

PP: Wow. So how long before you were operated on? Just a short time ... pretty much emergency surgery?

CCT: Within seven or eight hours.

PP: Oh, ok. And what did they tell you afterwards?

CCT: I don't remember anything that they said. Basically, I have very few memories of when I was in England. I was in the hospital there for about five weeks, I think. And then I came back to St. Charles Traumatic Brain Injury Unit in Port Jefferson. And I did two months there of speech, occupation and physical rehab. And then went into two years of out-patient.

PP: You worked with Dr. Sandburg?

CCT: No, I was working with Dr. Janer ...

PP: That's right. I spoke to Dr. Janer ... yes, he and I are going to be chatting in the next couple of weeks. He's gonna help me out on stuff ... interpreting the medical stuff. Good. Can you tell me some of the changes that you noticed ... either bodily or ...

CCT: I was paralyzed.

PP: Where?

CCT: On my left side. I still neglect it. I suffer from hemispheric neglect. So instead of reaching over to do something on my left with my left, I'll cross my body to do it.

PP: It went from head to toe, this paralysis?

CCT: Yeah. And I still wear an orthotic on my left foot because I have poor plantar flexion and I trip over my feet.

PP: Could you say that again.

CCT: I have poor plantar flexion in my foot so the AFO, or angle foot orthotic positions your foot.

PP: Right. Do you need that all the time?

CCT: Except when I wear heels. And I also ... in the surgery they cut a bit from my occipital membranes so I lost all left peripheral vision.

PP: Do you miss it?

CCT: Yeah.

PP: You notice a difference?

CCT: I mean, I'm driving, so ... But I compensate for it. My eyes no longer focus straight. Whenever I look straight, they always shift over.

PP: So that's pretty much the visual difficulties. Did you find any visual difficulties from the stroke?

CCT: Yeah, I suffered from severe visual spatial problems. I mean, you hand me a map and I can't do anything with it. It's incredibly hard for me. Puzzles and sequencing events, like with little picture cards, I find that really, really hard.

PP: If I handed you something, would you be able to reach for it and grab it?

CCT: Yeah, my coordination is pretty good.

PP: Just puzzle kind of stuff ...

CCT: Yeah. And sequencing ... and seeing the bigger picture, as Kevin would say.

PP: How about ... Did you notice ... You mentioned you were paralyzed left side. Any auditory ...

CCT: No. I didn't lose anything.

PP: So no hearing difficulties. Well, besides the one you would expect as far as motor difficulties ... It obviously has come back somewhat.

CCT: Yeah, I can play the piano.

PP: You can play the piano. How long did that take before you were able to resume, like, normal everyday activities?

CCT: Um.

PP: Were you left handed or right handed?

CCT: I'm right-handed. Um. I went back to school in December of that year.

PP: 1995.

CCT: Yeah. And, like, when I first started back at home, I was in a wheelchair. I couldn't walk. But by the time I was back in school, I was able to walk with braces, but they put me with a full-time aid. So I had somebody with me all the time because I had visuo-spatial and severe orientation problems. And they also had to reformat their tests because of the visual spatial problems. And I never learned how to read music. Speaking of music, I've played piano for nine years. I play by ear. Well, I can't reproduce, but if I heard it ... And I can memorize. So I would learn measure by measure by measure and then just put it all together and eventually have a piece. But looking at notes is just horrible for me.

PP: Would someone play it for you first, or were you able to ..(momentary break in interview)

PP: Ok. Do you still play the piano?

CCT: I quit taking lessons my senior year in high school, which was the 1999/2000 academic year, because I just had way too many things ... e-courses, and just college ... everything. The entire education. So I quit taking formally, but I still like fussing around on the piano. I like playing, and I've basically memorized almost everything I've ever played since I was 8 years old.

PP: So you have a good memory for ...

CCT: Yes, a good repertoire.

PP: Repertoire. Excellent word. So you memorized ... Did you memorize music prior to your trauma?

CCT: Um hm. I was always like that. I could never read.

PP: Now was there a specific reason for that?

CCT: Well, what has been hypothesized is ... when you have an arterial venal malformation, which is a clotted mass of capillaries in your brain, that because they're there, they cut off oxygen to that part of the brain ... so that part never gets developed fully. And so I never was able to do that.

PP: Ok. So it was in the works for a long time.

CCT: Yeah. Since I was born.

PP: Interesting. So you memorized prior to your trauma, and ... Do you think you'd still be able to?

CCT: Oh, I have.

PP: You have. That's excellent. Ok. Is there a difference in the way you go about memorizing music now as compared to when you were younger before the trauma?

CCT: I think it takes longer. It takes a lot longer for me to do it.

PP: Ok. But the process is pretty much the same?

CCT: Yeah, except I think that prior to my injury my memorization of my pieces went into my
long-term memory, but more currently it's gone into my short-term. So if I want to keep up playing a piece, I have to keep playing it, even after I've finished working on it. Otherwise I'll just forget it.

PP: Do you remember pieces that you've memorized before your trauma, now? Like if we had a piano ...

CCT: Yeah, from when I was like 6, 7, 8 years old.

PP: Ok. That's good. Obviously your memory is really good.

CCT: It suffered a lot after ... My short term is horrible ... names, faces. I have a lot of facial recognition problems.

PP: Well, don't feel bad because I didn't recognize you at first either. ... Well, tell me about that. So your short-term memory after the trauma ...

CCT: It was horrible.

PP: Do you feel that that's gotten better?

CCT: Oh, it's definitely gotten better. And that was just repetition. Repetition for me is the easiest way to learn something. But the problem that I had with college was textbooks, because there's too much information in a textbook ... a 70-page psychology chapter ... for me to understand. And it goes back to the bigger picture. I can't understand that, and when there's so much information thrown on me ... Like, I need outlines to know what I have to study. And the little bits don't really don't make much sense to me unless I have some sort of structured ... something ... to learn it.

PP: Before we get into the new stuff, did you do any performances or anything prior to your trauma?

CCT: Yeah. I accompanied Margarite Abramo, Middle School Choir on the piano when I was in seventh grade, which is the academic year before my brain injury. In sixth grade I played a piano quartet with the King's High Road, and I did that with three

other students in my year at the concert. And then I played in various recitals that my piano teacher had.

PP: Ok. Anything since the trauma?

CCT: Yeah, I continued playing for Margarite Abramo through my junior year. My senior year I just stopped playing piano. And I did vocal concerts and stuff. But in college I didn't get involved musically. It was way too competitive.

PP: Did you memorize all these pieces that you played pretty much?

CCT: Um hm. It put me in better stead because the other accompanists could only read and not memorize. So when his music fell off the piano that one time, he messed up and I just kept on playing.

PP: It doesn't matter. That's cool. Tell me about how you go about memorizing a piece of music.

CCT: I have to go measure by measure ... starting right hand, then left hand, or left, then right. And then just putting that together. And then once I have that measure, I can move on to measure 2. And then put them both together. And then measure 3. Then I'll have three measures of the piece. I have to go measure by measure by measure.

PP: Ok. And each time you go back to the beginning and play through it? Or could you start at measure 2 ...

CCT: Yeah. I have to go to the beginning so I can get it all together.

PP: Right. So it makes it like a unified whole. That makes a lot of sense. So you start with right hand?

CCT: Um hm.

PP: And then left hand?

CCT: Um hm.

PP: And then you eventually put them together.

CCT: Um hm.

PP: Now if you were ... Let's say you were memorizing something and you were distracted. Mom said, Clare, go take out the garbage. And then you came back and sat down ...

CCT: That's like with my studying. If I got a phone call in between reading something, when I got off the phone, I had to start again. I couldn't remember what the heck I'd been doing.

PP: Ok. Most of the pieces that you learned were in what style?

CCT: Um. I was sitting with Edith Lohonor and basically I played some abridged Gershwin, and then a lot of classical. A lot of baroque, and old romantic.

PP: Ok. Name some composers.

CCT: Beethoven, Haydn, Henry Purcell, Gershwin, and then various little people who had done music for Margarite Abramo's choir, and she just gave me the sheet music.

PP: Now when you memorize music, does your auditory ... does your hearing ... Is that the way you approached it since you didn't really read?

CCT: Um hm. I mean, what Edith stopped doing when she realized that reading music just wasn't happening for me was ... She had always played the piece for me before I would actually say, yeah, this is something I want to learn. But she actually stopped doing that because she wanted to try to get me to read it, but that didn't work. So she went back to playing it for me. And even if, like, I was playing a piece and I messed up, and she just played that measure that I messed up on for me, I could basically clear it up because I could hear what it was supposed to sound like.

PP: All right. Now if you were sitting at a piano now, and I handed you a classical piece that you had never seen before ...

CCT: I'd be a mess.

PP: Ok. But how would you approach it ... in terms of memorizing it? What would be the first thing you would do ... after you panic?

CCT: I would probably play over the right hand first, so I could get the melody.

PP: So you can follow the music a little bit? You're just not great at it.

CCT: Yeah ... I can't sight read. And then I'd probably try to put together the left hand, and then try to put them both together. It would take a really long time, but ... measure by measure by measure.

PP: Right. Now, this is a question I always ask people, and they never know what I'm really talking about. But if you think of the elements of music, like dynamics, articulation ... How does that play into your memorization? In other words, is there an order that you would do all this in?

CCT: I never really ever paid attention to dynamics, or anything. It was just how I thought it should be at that point in the piece. That's how it was.

PP: All right. So you wouldn't really worry too much about it ...

CCT: No, unless I was playing for NYSSMA or Guild Recitals.

PP: I saw you in last year's NYSSMA .... thank you for that. You did very well. As a matter of fact, I made mention of ...

CCT: It was my first time ever doing NYSSMA, too.

PP: Was it?

CCT: Yeah.

PP: And they made mention of how nicely you did the articulations and dynamics. Is that just because you were interpreting it that way?

CCT: It was because it was being hammered into my head by my vocal teacher and she was like, at this point you have to get louder. But I don't know ... I never did NYSSMA for piano. I always did Guild for piano. And that was very traumatizing. But I never liked playing in front of people. I've never liked it. I always get so nervous. But I just deal with that on some occasions.

PP: If you had to pick a number of pieces that you could sit down and play for me right now, give me a ball park amount.

CCT: Probably over 10.

PP: Ok. Clare, do you play various styles of music, or did you play various styles?

CCT: Well, I basically was shoved into the classical corner because my first piano teacher ... Her name was Eve Barsham ... She has edited a number of books. She

loves Haydn. And she is in England, and basically British people are not known for their jazz piano. So I was shoved into playing classical with her. And that basically carried on with Edith Lohonor when I started with her when I was 9. And I basically just play classical.

PP: How much time would you allow to memorize a piece? Let's say, now ... I know you're not into it exactly now, but let's say you had to play just one piece ...

CCT: Um. It would take me like a month. I never diligently practice. Practice is not my thing. I like being able to play, but never liked to practice.

PP: Ok. Do you find it easy to memorize?

CCT: Um hm.

PP: Do you enjoy playing from memory?

CCT: Yeah. I like being able to go to the piano and rattle off something.

PP: Yeah, that's cool. If you had to pick something about the whole memorization process that makes it hard, what would that be?

CCT: I think the long term ... because I can get it in the short term, which actually sounds weird since my short term's supposed to be bad. But I can memorize something and have it there, but then if I forget about it for a while, it won't be there when I ...

PP: Before I forget, there was a question I wanted to ask you before that I forgot to. It concerns the senses. After your trauma, did you notice any ...

CCT: Apparently from the hot/cold test that they do with the metal things against your feet ... that was off. But I don't know. I couldn't ... I had little or no sense on my left for like a long time. Apparently, when I was in the hospital in England, I was

lying in bed, and my dad was sitting next to me ... People with brain injury tend to suffer from disassociation ... and so my dad said, Clare, can you move your arm? And I looked at my arm, and said, dad, that's not my arm. And to me it wasn't my arm. But it was.

PP: Wow. How would you rate your success at memorizing things in the past? On a scale from 1 to 10, how well did you memorize?

CCT: Post or prior?

PP: Let's do prior first.

CCT: Before it was fine. No problems ever.

PP: From 1 to 10?

CCT: I'd give it a 10. I was really, really good.

PP: Ok. And how about post?

CCT: It took me a lot longer. I'd give myself a 6 or 7.

PP: Um. How important do you think is confidence in the ability to memorize?

CCT: Oh, it's very important because my little sister, when she started playing piano, she wanted to be just like me. She can't sight read either. She only played for a year though.

PP: How old is she?

CCT: She's 15 now. We're 3-1/2 years apart. She couldn't read either, and she didn't have the musical ear that I have. So she kind of gave up very quickly.

PP: Do you feel that confidence is related to memory at all?

CCT: Yeah, I think definitely. I know if I told myself, I'm gonna fail physics, I will. And I've gone very optimistically into things, and haven't done too well, but I know that if I had been in the mental state of mind where I was like, no, that's not happening, that it probably wouldn't have happened at all.

PP: How about confidence in your ability to perform?

CCT: You have to have that. Otherwise you'll never get up and perform. If you're not confident that you can do at least a half decent job, you'll be too scared to go up in front of people.

PP: True. Was your confidence or self-esteem affected by the trauma?

CCT: Yeah, mostly social, because I was rejected by everybody. I lost ... I had been class president ... fourth grade class president, fifth grade school president, sixth grade student council, seventh grade ... and I came back to school in December of that year ... Everybody was so happy to see me back, and I had like a portfolio full of cards and letters from everybody ... Oh, Clare, we miss you, we love you, we want you back, hope you feel better. And when I got back my behavior was so off and disinhibited, that everybody just left me, and I was left with one friend who was a social outcast herself ... who was valedictorian of our school and is now at Columbia ... but I don't know ...

PP: Just in general ... musical taste of records or CDs ...

CCT: If I'm gonna buy anything, it's gonna be hip hop ... and I love R&B because I love singing.

PP: Ok. Is that different than you used to be, or that's been consistent?

CCT: No. It's been consistent since I was in fourth grade.

PP: So you like that modern, techno stuff?

CCT: Yeah, much to my parents' dismay.

PP: Can you tell me the titles and composers of some pieces that you could rattle off? Just maybe two or three.

CCT: Um, "Sarabande" by Purcell... I think. No, "Sarabande" by somebody else. "Horn Pipe" by Purcell. "Scherzo" by Haydn. "Somewhere Out There" from *The American Tale*. *American in Paris* by Gershwin.

PP: I don't mean to stop you, but give me an example of like NYSSMA levels. Where do you think they would fall?

CCT: Oh, NYSSMA. I don't have the slightest ...

PP: Well, let's take easy, medium and difficult. Where would they ...

CCT: Probably medium.

PP: All of them? Any one difficult? Or any one of those pretty easy?

CCT: No. Just medium.

PP: When you are memorizing, do you use any visual tricks?

CCT: No. Visual just isn't good.

PP: How about touch? Like motor memory ... kinesthetic ...

CCT: I can play pieces with my eyes shut. I can play pieces blindfolded. I can do that. Because ... I can dial a phone without ... because I know where the keys are. And I actually ... This goes along, I guess, with music. I know how the button sounds when you press it. So I'll be sitting in the kitchen with my dad, and if the phone goes [makes the sounds], I know that he's dialing my mom because I know that that's 928-2180. And I actually know the sound. That's just my own quirkiness.

PP: No, that's pretty darn good. Do you feel that way with the keyboard?

CCT: Um hm.

PP: So you think you know the sound of the key before you hit it?

CCT: I can do that. I mean, I guess I kind of need middle C before I can ...

PP: You need a reference point.

CCT: Yeah.

PP: Ok. I think that's it. We talked about everything.

Interview with JJ

PP: Ok. Jordan. After your trauma, what were some of the changes that you noticed ... some overall changes?

JJ: Overall changes ... just as far as my head goes, or even physically?

PP: Even physically.

JJ: Well, since I broke my neck, I have headaches all the time. My body is like sore ... my neck and shoulder areas are sore all the time. As far as mental changes, my recall of things is slower ... even like words ... like when I'm having a conversation with someone and I'm trying to say something, like a certain word that would be normal for me ... it just would not come to me. You know, it would come back, but it had to wait a while. The same thing with people's names or any kind of memory. It just slowed down.

PP: Ok. Did you notice that with short-term stuff ... like remembering a phone number that you just looked up in the phone book?

JJ: No, I just noticed it with like linguistic stuff ... like words and names ... like that.

PP: Did it affect your music playing at all? Recalling names or things like that?

JJ: No, not like that ... not that kind of stuff. It was just more like ... not that.

PP: Any physical things, besides the headaches? Any motor things?

JJ: No, no. Just, like I say, the arms, shoulders.

PP: Did they do any operation, or was it medication? How did they approach your ...

JJ: Well, first it was a halo brace. That's where they holes are. You know, the thing where they drill the thing to your skull ... with the poles ... with like this vest-type thing around your body so you just can't move your head. And then ... other than that ... nothing as far as physically. The other thing was I had a seizure, so they put me on phenobarbital for about a year and a half so I wouldn't have any more seizures. That's it as far as treatment.

PP: Ok. Did you perceive any auditory changes?

JJ: No.

PP: So everything remained ... You could hear fine and understood?

JJ: Yeah.

PP: Ok. Any sensory difficulties?

JJ: No. There wasn't anything.

PP: Ok. Your daily routine that you normally went through in terms of waking up, brushing your teeth, and all that ... Were there any changes or any adaptations that you had to ...

JJ: Well, right away I was in the halo brace for about three months, and then after that I was in like a neck brace for a couple of months after that, and being immobile for a while ... everything was like atrophy. So as far as that goes, you know, that type of normal thing was, um ... But other than that, you know, as soon as I was out of any kind of, you know, bondage, you know ... Otherwise I was fine. But then for a year and a half afterwards I was on phenobarbital, and that just wiped me out.

PP: What's the effects of that? I'm not ...

JJ: Well, you know, it suppresses ... I don't know what it does exactly. I guess a doctor could tell you that. But the effects that I felt ... I was just tired all the time ... just totally tired ... dead tired ... just sluggish. And the doctor said that it was from the drugs. So I assumed all that was from the drugs. I didn't attribute it to the injuries.

PP: Did you have occasion to memorize music prior to the trauma?

JJ: Oh, yeah.

PP: And how did you ... tell me about your memorization process.

JJ: Well, that's an interesting thing because at a time I had grown up studying classical music ... classical trained ... and when I ... at the time, I was doing mainly jazz kind of stuff. So before I'm memorizing like classical ... totally isn't like memorizing jazz because when you're memorizing jazz, it's all based on chord and harmony ... as opposed to just memorizing melodic lines, you know, like lines of music. At the time I was learning chord functions and things like that. So let me see ... What am I trying to say? Yes, I had done a lot of memorization and ... I didn't see any changes to it.

PP: Can you tell me a little bit about the process that you would go through to memorize a piece of music? Let's do classical first.

JJ: Like ... I play through a piece of music once, and then close the book and put it on the other side of the room and just try to remember as much as I could ... play through until I could not ... Yeah, try to play as much as I could and then when I couldn't remember it, I'd go over to the other side of the room, look at the music. Because my old teachers told me to do this. And then look at it without playing it and go back and try to do it again from memory. And the other process was I would sit with the music and a piano, and learn the music and sing it. For example, like learning the Bach solo cello suite, the teacher said, before I would play it ...

You know, play through it once just to hear it and then sit down at the piano and sing it ... be able to sing it through. So I would memorize it ... learning it like a song. And then go to the cello to play it.

PP: So primarily right now when you're talking about classical music, you're talking about the cello?

JJ: Yeah. Pretty much. Any classical playing I did on bass would be just chamber music. I wouldn't be memorizing it. I wasn't doing any kind of solo recitals or anything like that. Just cello.

PP: Let's skip around a little bit now because we're heading in a direction I'm interested in. If you think about the elements of music, what order would you say you put the memorization process in when you memorize classical music?

JJ: I don't know what you mean.

PP: Ok. In other words, I'll try not to feed you like I always fall into the trap. The different elements of music are articulation, dynamics, ...

JJ: You mean importance?

PP: Importance ... or the order that you would say ... Of the importance of memorizing them, how would you handle all that?

JJ: Sigh. I don't know. I never ... I did memorize stuff, but that was never a thing I really worked on much. I was not doing much ... I wasn't doing recitals or anything like that. I was always ... I didn't put in much chord time. I wasn't working on that ... I was doing mainly chamber music and stuff where I was not memorizing things.

PP: Oh, okay.

JJ: You know, when I had done memorization before, it was like when I was in school, college, or recitals. But that was never what I was working on doing. As far as jazz goes, that was the most important thing because that's ... at the time I was working and gearing all my stuff towards just playing ... like, doing jazz gigs and playing clubs, you know, where you had to know all the songs. And then I was learning, you know, of course you learn the melodies. But I was just working the changes. You know, as a bass player, you gotta know all the changes. You know. And then working on transposing them. Like I would take a tune and I would play it, learn it, and then try to play it through all 12 keys. That was one of my practice routines. So I could understand ...

PP: That's a very good way to do it. You mentioned that that was a difference between memorizing classical music and memorizing jazz. Just tell me a little bit more about that.

JJ: Well ... when you're memorizing a jazz piece, you're memorizing one, you know, like a page of music, as opposed to a classical piece where you're memorizing [break in tape] ... Yeah, when you're memorizing jazz music, it's like a page of music ... like one tune. Classical music ... you're just memorizing a line and going and going. Of course it's not just a line that keeps going. There's like ... there's sections in that. But you're memorizing something. You don't memorize it the same way. Do you know what I mean?

PP: I know exactly what you mean. But I can't admit to that.

JJ: Yeah, I mean chords and sections ... you know, there's ABC sections in a piece of music, but you don't think of it the same way as far as jazz goes.

PP: So, in classical music, you would maybe ... I don't want to put words in your mouth ... But might you do it in sections?

JJ: Oh, yeah, definitely ... definitely in sections. But when it comes ... but it's not like, ok, I'm coming to the bridge ... like you were. And of course it's not a sonata-allegro form. There are sections like that, but you don't memorize it quite the same way.

PP: Ok. So in terms of your memorization of let's say a classical piece, how long a phrase might you attempt to memorize at a time?

JJ: Like an eight-bar phrase, maybe.

PP: An eight-bar phrase. And you would designate that primarily melodically, or by ...

JJ: Yeah, I would do it melodically first ... something cello. Of course, you want to know what's going to be happening in accompaniment. You know ... chorus ... but ... It's funny ... I have not done that type of playing much. You know, my main thrust from that point on was jazz and pop music.

PP: Right. When memorizing, do you ever utilize ... I wouldn't call them tricks, but little aids like trying to visualize the page or ...

JJ: I try to avoid visual memory. I try to do it all auditorially.

PP: Ok. How come?

JJ: It's music. It's not painting. It's music.

PP: Fascinating. Did you ever try any auditory aids like a tape recorder or ...

JJ: No. Just singing. You know, I can sing songs ... I've tried to get my playing on the instrument the same way ... just like I'm singing. You know how you sing something, and you remember it forever? I just try to get that ... make it that basic.

PP: That's really a good way to do it. Did you find memorization prior to your trauma an easy kind of thing?

JJ: No.

PP: You really had to kind of work at it?

JJ: Yeah.

PP: What did you find was the problem?

JJ: [he laughs] Remembering.

PP: Pretty much what everyone says. Maybe I'll cross that question off.

JJ: Yeah, just remembering, you know.

PP: But I mean, did you find ... When you were memorizing, let's say, a little classical piece, did you instinctively remember dynamics, articulations and things, or did you ... start simpler and then work to that?

JJ: No, I think that was pretty instinctive.

PP: I think for most people, that's true. Um. Did you teach at all prior to your trauma?

JJ: Yeah.

PP: And have you continued teaching now?

JJ: No, I don't teach now. Thank God ... I don't like teaching. I just stopped teaching about two years ago ... teaching private lessons.

PP: Did you ... Let's go in a different direction here. If you had to memorize a piece now ... let's say, they ... even for the pit. They said, ok, we're gonna do one show by memory. Would there be a difference in the way you would approach your memorization from the way you used to do prior to trauma, or would you instinctively pretty much stick to the same way?

JJ: I'd do it the same way.

PP: Probably because it works. And ...

JJ: Because when you're memorizing it, I don't think ... When I'm memorizing this type of stuff ... like if I'm doing it in a pit ... I'm playing bass, so I'm playing the changes. I'm not playing melodic lines. Maybe begin there, but I'm memorizing the harmonic changes. So I'd memorize all of that because I'm thinking, you know, I'm playing ... I'm not memorizing notes. I'm memorizing the whole thing.

PP: Good. Oh, I'm curious as to ... If you had to play something by memory, what criteria would you use to judge how successful you've been? Like ... maybe that's not worded correctly, but if you wanted to judge ... Let's say you were asked to do this show by memory. What kind of scale or what kind of way would you look at your success, or even the group's success in terms of memory? Just explore that a little bit.

JJ: Well, if it was memorized. [laughs] If it was memorized, it was successful. If I didn't, it's not successful.

PP: Ok. But what aspect ... Would you be more upset at, you know, like missing a cue or missing notes, or like ... I'm trying not to feed you ...

JJ: Oh, I'd be upset if like ... I'd be upset if like ... if there were cues that I would use ... you know, audible cues ... and I missed them. I'd be upset at that ... because I'd be saying how come I'm not listening? I should be listening.

PP: Ok. Do you play various styles of music? I guess the answer would be yes.

JJ: Yeah.

PP: And the methods are the same for each of them? We just touched on this by just exploring ...

JJ: I do a lot ... I do play a lot by memory because I play in a lot of pop bands. I do like a lot of shows ... you know ... stage shows. Not this kind of stuff. I do like ???. That's all ... That's all memory. You know, so ... But once again, it's not like ... I'm not playing the lead instrument. I'm playing in the rhythm sections.

PP: So in a sense for you it's a little easier to memorize the changes, and harmonic structures rather than if it was a melodic line, like some instruments might have.

JJ: Yes, because one thing that you're memorizing ... one chunk ... stands for a lot, as opposed to each individual note. Because then I'm thinking ... I'm not thinking, like, you know, D minor G7 C ... I'm thinking II-V-I. And that's a whole chunk. Like when I would teach, I would talk to my students about that ... about when I look at a page of music, I don't look at a page of music and read OMNIDIRECT (he spells out the letters). I look at it immediately as OMNIDIRECT (he just says the word) as opposed to ... So I try to make my memorization into that ... seeing things in chunks. So II-V-I is not three separate things. That's like ... II-V-I is like one chunk.

PP: That's really cool. That's exactly the type of stuff I'm looking for.

JJ: And then on a bigger scale ... So I can memorize something ... oh, it's rhythm changes ... oh, ok, [inaudible]. That's one part. You know what I mean. It's like blues. You think blues ... that's like one thought. You're not thinking in each individual chord.

PP: Ok. So you like seeing the bigger picture and taking it in as a whole, rather than seeing or analyzing structures.

JJ: Exactly. Exactly.

PP: I just fed you a lot, but I don't care. That was worthwhile to get out. That was good. How often do you currently perform from memory? Or do you still do that at all?

JJ: Well, it all depends, you know. I just did ... like right before I started this run here ... I was playing with a band where we were doing lots of stuff from memory. But not much now. Now I'm in the pit reading music. But it's funny, though. I just do it automatically. For example, the last show I did ... "The Best Little Whorehouse in Texas" ... that show, "24 Hours of Loving" ... I play in a ... Did you see that show?

PP: I missed it.

JJ: Well, ok. In one scene, "24 Hours of Loving," I'm on stage playing and there's six girls in like ... wearing lingerie. So immediately I said I'm getting off book as quick as I can because I got something to watch. So, right away, I knew ... it was just like, it was an 8-bar frame that just kept repeating, you know, over and over. So I learned that ... I learned that quickly.

PP: I know that piece. We did it for the cameras right before opening. So I got a chance to play that ...

JJ: And the stuff ... there's always licks that were written out on the page which were not working because the band, you know, was not ... the band was very busy. They were playing parts that were busy. So I simplified the parts that was written on the page. So, I mean there are more than just chord changes written. So I guess what

I'm saying is I've learned quickly that in doing shows, it's one thing to play the page and another thing to play the book. You know, everything that's written on the page is not always what should be played. You know, you learn that quickly ... because like bass players don't ride on the bass lines ... they're not bass players. And they don't know what sounds good.

PP: I find adapting show music constantly when I play the piano ... to what I know it should be rather than what's written.

JJ: Yeah, exactly. That was me in this last show. And even in this show. You know, there's stuff ... It's "Pippin" ... like the book was like insane. The bass was all over the place ... you know, the octave jumps back and forth ... very busy lines. And I went and listened to the Broadway recording, and the bass player. He was not playing what was in the book. It didn't make any sense. So that, you know ... just being able to hear that is important. So once I start listening to it that way ... playing the changes ... I can memorize that stuff quickly. So I do play from memory a lot, but I don't have to because I'm not ...

PP: Wow.

JJ: But I was never a big memorizer. That was not something that I did before that I don't do anymore. I just do it when the occasion calls for it.

PP: I find myself relying on the book just as a security blanket.

JJ: Yeah, yeah.

PP: I can play most all the shows that I've done, I mean, as I'm doing them. But I still look just to be sure.

JJ: Yeah, yeah. I try to get off the book as quick as possible because if you can, then the music will come out. Like I said that thing before about, you know, not

thinking of looking at a page. I just think of it as like the music ... just think, not visually ... just hearing it.

PP: That's great. How important is the confidence element, do you think, in memorization for most people?

JJ: I think it's pretty important ... because if you're not confident, you're gonna play like you're not confident.

PP: Yeah, it's gonna come across probably. Did your self-esteem and confidence get affected by your trauma, and in what way?

JJ: Well, that's interesting. I mean right before ... this has nothing to do with that ... but before that, I was ... um ... I had a liver transplant the year before. So, you know, my self-esteem and confidence was pretty damaged by that because all through my 20s I was sick as hell. I was like down to like 112 pounds. I was jaundiced ... just looked like death warmed over. So after I had the transplant, very quickly my health improved, you know, greatly. I gained weight. I looked much better. People didn't know it was me. So right away I'm doing really well, and then about ... it was just about a year afterwards, I'm in a halo brace. So that did affect that because it was a setback. But I don't think it really affected my confidence because I had been through so much before, you know, I didn't think of it as though I was never going to recover or anything.

PP: Now your trauma ... was it an accident?

JJ: Auto accident.

PP: Auto accident. Ok. I don't think I heard that before. Um. Did your musical tastes change, before and after trauma.

JJ: No.

PP: You pretty much listened to and played the same things.

JJ: Um hum.

PP: Um, talking about classical ... Which composers did you find that you listened to a lot of, or really enjoyed playing?

JJ: Ravel ... I don't know. I used to like all ... pretty much everything. Um ... but I listened to a lot of Ravel, Schubert, you know, a lot of Beethoven ... because I did a lot of string quartets. A lot of Beethoven ... Pretty wide taste. Like if you look at my record collection, people are pretty surprised because I listen to a lot of different stuff ... country and western.

PP: Really?

JJ: No, it's a joke. [laughs]

PP: I was gonna say, that would have shocked me.

JJ: Yeah, I'm not a big fan of country music.

PP: No, I'm not either.

JJ: But I am a big fan of like Irish music ... that's something I really came from.

PP: You know what I like about country? I like the type that sounds like 70s rock and roll. When they get into that ... you know ... That I can tolerate, but the other stuff I kind of shy away from. Um.

JJ: When people ask me if I like country music, I always say, which country? Afghanistan, Croatian ...

PP: What nationality are you, may I ask?

JJ: American.

PP: I mean ... but your background ...

JJ: Well, my parents were both born in America, but my grandparents were from Poland. But my mother's side ... they've been here for a long time.

PP: Ok. Some of this is already kind of self-explained in things we've already covered. Oh, yeah, the idea of like a tactile approach to memorization. Do you ever ... I'll give you an example. Sometimes if I'm playing like a jazz piece, and I'm gonna play a jazz solo, there are certain things that I ... that feel good on the keys. I guess it's just my style, or whatever. But there are certain ways that I also use that tactile or kinesthetic feel for memorization purposes. Do you ever ... feel ... Do you ever think of that way?

JJ: For memorization?

PP: Yeah.

JJ: For memorization, you mean, of melodic lines and things, or just intervals, or ...

PP: Even intervallic ...

JJ: Well, that's a receptive sense, where you're ... you know ... your muscle memory type of thing.

PP: Yes.

JJ: Yeah, I do that all the time ... many times because I'm playing with a band that's so friggin' loud that I can't even hear stuff if I'm playing my bass. So it's all tactile ... especially shifts and things like that.

PP: So you can feel it ...

JJ: But that doesn't come in the category of memorization for me ... you know ... because my guys like playing ... even when I like playing something written down.

PP: Well, I was thinking like if I was playing a Chopin etude or something, where there was this certain scale line ... I'm thinking of one ... I can't remember the name of the piece, but it's like a G flat major thing ... starts on F though. And the fingers fall, and I didn't ... I remember this was the first time I thought to myself ... I didn't have to say, "ok, I have to memorize these notes," but I was able to say, "there it is."

JJ: Oh, yeah, yeah, yeah. I know what you mean. Oh yeah. Well, for example ... yeah, I know what you mean. Like if there's a run ... that's a category of a scale ... yeah, there are patterns that I work in that fall under my hands, and oh, that's just like a major scale. I'm not thinking of the notes.

PP: Like chunking. What you were talking about before.

JJ: Yeah, I break it down into chunks, or arpeggios. I know there's like a certain type of sound I hear for certain pitches. Yeah, yeah. I didn't know this would fit under the category of memorization, though.

PP: No, I don't either. But if I had to memorize a piece, I think I could see myself utilizing that as a possibility of memorizing a certain part of it.

JJ: Yeah, yeah, I get you.

PP: Cool. Tell me about ... Do you perform for a living?

JJ: Yeah.

PP: Ok. A lot of people that I've spoken to don't ... or they're part-time performers. So you perform pretty much weekly ... a lot ...

JJ: Daily. Like for example, the days off here ... You know ... This next day off I have a job up in Connecticut I'm doing for a July 3rd party. The week after that I'm doing a recording session. The week after that day off, I have another job up in Connecticut ... You know, private party. And that's pretty much how I've been for like the past few years. Everyday ... I was looking forward to days off because I don't get too many days off. I've been doing a lot of touring, like right before I came out here, I was on a tour.

PP: What was the tour?

JJ: It was ...

PP: "Company?" ... you were talking about on the phone ...

JJ: No, no. Well, I did "Chess" but that was ... Tours ... I guess I talked to you on the phone. I did "Company." I did "Chess." But before that I was doing ... playing Broadway reviews ... It's like people who've been on Broadway do the songs they did ... "best of" type of thing. So I was doing those industrials. I was around the U.S. with that. Barbados last. Yeah, so lots of that stuff ... touring all the time. I also do ... I work with this pop band. We just did a ... We do like jobs just around the area. You know.

PP: So you do like Top 40 and that kind of stuff?

JJ: Yeah. Well it's not Top 40 because it's stuff that's like new. It's not so much ... not like cover bands, or anything ... all original material.

PP: Oh, original material. So what type of audiences do you find yourself performing for mostly?

JJ: Mostly ... I guess show audiences ... not necessarily concert types because that's what's out here ... but people who go to shows. I also ... dance clubs ... where people are there to dance ... which I like. I love that.

PP: Um. We did it. Ok.

JJ: I just have to get you the name of that doctor.

PP: Yeah, if you could do that.

JJ: I got to find that.

Interview with LH

PP: All right, I'm talking with LH. It's September 25, 2000. Larry, why don't we start with ... like a little bit of your background first ... like your musical training, that kind of stuff.

LH: Ok. When I was 8 years old I was more or less drafted into my church choir because I was going to a Catholic school in Philadelphia, and it was a big parish and the church was ... had one of the biggest domes in the world. It's St. Francis de Sales in West Philadelphia. And they have a 6,000-pipe organ there. And it's just an absolutely wonderful experience being in that church and hearing that organ. We had a bishop for the pastor of the church. Apparently he had connections and he talked to the Pope about wanting to have a choir that was fitting for this beautiful church. So the Pope sent him a priest named Father Angelo della Pica, who had been directing the Vatican choir because of his extensive knowledge of sacred music. And he became the choir director, and he immediately held auditions of all boys around my age, and you didn't really have much choice. You either were in the choir or you weren't.

PP: How old were you then?

LH: I was 8. I was in ... I guess second or third grade ... I guess it was third grade. And I started immediately ... because I was in it for six years. And he would teach us basic forms of reading music, but we really didn't read that much because he wanted us to learn everything by heart. And we sang everything in Latin. We did a lot of Greek masses ... all kinds of foreign languages. We learned some German ... all types of European-based language in the masses. We would do high masses every week ... and Christmas ... Christmas was a big season. And there were a couple ... two or three years where we had the strings section of the Philadelphia Symphony Orchestra come into the church, and they would be up in the choir loft with us. And they would play along with the organ and the boys choir. It was quite an experience for me. And I did that for six years. During that time I ... After about three years I learned how much God-given gift I had in music ... as far as my ability to hear the

harmonies and know the different parts before he would teach the other ... I was a soprano for that time I was in the boys choir. And he would give out the parts and I would already know them. I had it in my head. I knew what all the harmonies were. I remember one Christmas Eve we were doing the high mass and ... you know, we were very young, and it was still very late for me at that point in my life to stay up until 1:00 in the morning for the midnight mass. And I would be kind of drowsing and so to keep myself awake I would basically be out-of-body experiencing ... I would go into the alto section and sing their part, and I'd go to the tenor men's group and the bass men's group and sing all their parts to keep myself from falling asleep. And one year I was doing that and I had my eyes closed, and he reached over and he just tapped me on the cheek to wake me up ... He knew something was going on. He didn't know exactly what. During this time I also started becoming involved in teaching the other guys about harmonies, and we were singing doo-wop songs and all that stuff that was on the radio on the time. And by eighth grade I was also singing at the eighth grade graduation dance with just a doo-wop a capella group. And I was also starting to think at that time that I was going to be finishing up with the choir because I would be going to a different high school. So I figured I should get into something musically on my own, and maybe undertake instrument training. So I really didn't know anybody, except one friend who was playing guitar at the time. And I asked for a guitar for my birthday, and my father got me one when I was 13, and that was my first guitar. So I started teaching myself because I didn't know anyone who had teachers. And so I started learning and got pretty adept at it right away because I was ... It was, at that time, Peter Paul and Mary, Simon and Garfunkel were happening, and on the other end of that spectrum the Beatles were appearing on Ed Sullivan, and I was sitting there with my guitar watching all this happening. So I just kept going with it, and by the time I got my license ... I know the day that I got my license I actually had a gig that night. I had to borrow my father's car that night to go out and do a folk trio. I had a folk trio called the Millstone Trio, and it was really big in Philadelphia. So we were doing really well playing the folk circuit, and hootenannies and making a little money here and there. By our senior year we had a manager. He said his name was Mr. Simpson, but he didn't look ... He looked Italian, which he was. He hired us ... We

were working gigs at the ... let's see ... the PAL leagues for the younger kids on Saturday afternoons. And we were getting pretty good, and we caught his eye, and so he asked if we wanted to make some money. So we said, sure, and he said he could get us $50 a piece on certain gigs. And this was in the sixties. Wow, that would be great. So he took us down to a place on South Broad Street called The Venus Lounge. And he took us in the back door, and up into this upstairs. And we had to wait until it was just the right time. And we were up there, and there were pool tables up there, and we were sitting around wondering what it was going to be like. So they took us downstairs finally and we were just going to play one set. And so we got up there and we just did our one set, and I'm watching all these people. And all the men were smoking big Cuban cigars, you know, and had big old pinky rings on, you know. And their wives were dripping with diamonds, you know ... tiaras, and diamonds from the ears, and big necklaces. And I was saying to myself, these must be really incredible successful businessmen. You know, they're all dressed. And I figured out years later, you know, being on South Broad Street in South Philadelphia at The Venus Lounge, I mean they were probably Mafia dons and their wives, you know. But we got paid $50 to do that on a Wednesday night on a school night. We were working The Venus Lounge, The Scaparato Lounge, and places like that. And then after senior year, you know, the other two guys in the Trio went their way ... they went off to college, and I was waiting to get drafted, which I did. So that's what happened with that. And then I bought a cheap guitar to have in the Army when I got drafted ... and just kept practicing. After the Army, I moved to San Francisco, and the first guy I met in San Francisco had just gotten out of the Navy. I had just gotten out of the Army. And we just bought Martin guitars, and we put together a duo ... started working folk clubs on Hayde Street in San Francisco. And one of the first gigs we worked ... just him and I playing acoustic guitars ... the people were there, and they loved the songs. It looked like we were going to be successful. And we went outside to sit in his micro-bus through the set to plan our next set ... during the break. And we walked back in after the break and there were these six black guys who had snuck around the corner with their amplifiers and electric guitars, and they started playing this loud dance music, and the people were just grooving to that then. And they stole the gig right out from

under our noses. And we were both going to run in and say, hey, that's our gig. You can't do this. And I realized ... I said to him ... His name was Tim ... Tim Burrows. I said, Tim, we lost it. There's nothing we can do. And he said, yeah, but it's our gig. I said, but even if we went in and forced them to stop, they've like totally changed the whole idea. It's like the changing of the guard ... because they're playing electric music. And the people were sitting there drinking coffee and enjoying our music, and they loved it. But now they're all up boogying ... they're dancing to this louder, electric music. We can't go back in there and reintroduce acoustic music. It's like anti-climactic. And so it's not ... It's a sign that it's not just a change of this particular gig. It's a changing of times, and we have to kind of look at this ... if we're going to work. So at that point we started thinking seriously about ... what could we do? And I had already been playing bass ... electric bass ... for several years. So we decided to start a band and we went from there to ... (laughs). And we started a band and it was all electric, you know, because that's the only thing that was getting hired. The folk scene was really just being totally shipped right out.

PP: Wow.

LH: The end of an era. That was 1970 ... the winter of 1970 ... the end of 1970. That was pretty amazing.

PP: Yeah, that's incredible. I never lost a gig like that. (Both laugh.) I've had a few. A guy would call me up to play a job and ... a piano thing I remember in Greenport. And I showed up ... and it was like three days before, and I showed up to play for a little cocktail music, and he had sold the piano and forgot to call me. Some guy came in and said, hey, I like your piano. I'll buy it from you. He said okay, and didn't bother to tell me.

LH: Unbelievable.

PP: I guess we all have our war stories.

LH: Really. As musicians it's a tough way to go at times.

PP: That's cool. Anything else you want to add about your musical background that you think might be important?

LH: Ah. I guess from that point we started electric and we put the band together. We started jamming with everybody that we knew. And the next thing we know ... The band had a chance to go on the road, but there was another guy who was a better guitar player than me ... had more experience playing electric. So he kind of took over my spot. And I said, well, I'll play bass. But they had a better bass player who wanted the gig. So I was kind of aced out on two categories there. And they went on the road. They got an offer to go up into ... We were in San Francisco, and they got an offer to go up on the road up in the northwest ... based out of Portland, Oregon. So they did that. They took off, and I stayed there in San Francisco. And I decided that the best thing that I could do was to wood shed, as it's known in the music world ... is to just get as good as I could. And I would spend that entire winter up in my room in this house in the upper Hayde area of San Francisco. And I would just wood shed. I would listen to records. I would learn as much as possible. I would practice all my waking hours. And then I would go out from there and get myself a job and start working as a professional musician. And that's pretty much the way it worked out too because I spent that whole winter into the spring. And I put out the word that I was looking for work, and I had been working before that previously ... I had been working at the phone company, and I knew a guy who was a part-time musician. And he had also left the phone company because he finally got his law degree. But he played keyboards. And he had an old friend who was a nuclear physicist working on the space shuttle program ... the original space shuttle program at Motley Field, south of San Francisco. And they had a friend who was a professional ... I guess a mechanic ... but he had advanced himself to where he had bought cars and bought cars, and he had this fleet of antique cars. So I told him I was interested in being in a band, and he said, well we're looking for a bass player. Could you do that? And I said, yeah, I've been practicing for a while. I could do it.

So we had our first rehearsal ... and the guy who owned the cars came and picked me up in a '26 Pontiac, and we went to rehearse, and we put together a band called Wheatstone Bridge, which is some theory in physics ... I still don't know what a Wheatstone Bridge is, but it's a physical theory named by the guitar player who was the nuclear physicist. And we started a band, and I started working a whole lot with them ... practically every weekend ... making good money. And from there it went just onward and upward for me. That was like ... still kind of like my basics of how my music career started. That's the basics right there.

PP: Cool. Very interesting. If you don't mind, would you just go through your accident, if you wouldn't mind.

LH: Ok. Let's see. During my career in music in San Francisco, I met my wife inadvertently by being booked into a club and she was doing the booking for a club that was on Hayde Street in San Francisco. I had a band called Heroes, and we were one of the more popular unsigned acts doing original music of our own in the San Francisco area. We were playing all over northern California. And we were doing opening shows for Moby Grape and Jesse Collin Young, the New Riders of the Purple Sage, Stone Ground ... a lot of bands who had been around and were successful in San Francisco. And so we got booked into this club called the Shady Grove on Hayde Street, and the girl who booked us in is now my wife. We met ... When we played that first night there, we kind of just were smitten with each other, and a couple of weeks later we were just inseparable. So we got married within a year and a half of that. That band broke up, but we kept on together, and I wound up working for years with Jerry Miller, the guitar player from Moby Grape, because we became close friends. We worked together for five or six years and then my wife got pregnant. And when my daughter was born, we decided to move back East because we were both from the East Coast. My wife grew up in Queens, and I grew up in Philadelphia. But there was a lot more work available up here. And I had along the years done a lot of jobs on the side driving vans and cars ... and I had driven a van for the phone company for years. And so I decided to get a professional license for driving trucks so I could make money for the family ...

besides the music. So I did that, and when we came back here I put in applications for professional driver. And I got a job driving a flatbed 18-wheeler for Georgia-Pacific Corporation in Yaphank. So I went to work for them, and it was steady work ... very secure company with good benefits and all that kind of thing that you need for a family. So I got right into that, and I was working on the weekends with a wedding band almost immediately when I got back here. So I was working a lot of times seven days a week, but providing for my family. So I had been with Georgia-Pacific from April of '86, and then in September of 1997 I was in the process of loading a truck, and I was driving a forklift around, loading up different types of materials to put on the truck for delivery that day. And I had to go up a mobile ladder that we used to go up to a height to get material off the racks, up high. And I had to get this material up high, and I had done this many times. And I moved the ladder to where I had to go up to reach this material, and then climbed ... I guess it's about 12 or 13 steps ... 12 or 13 feet high up this ladder. But when you put your weight on it, it locks in place, and it doesn't roll any longer. And I was up there, and I was bringing these long 12-foot-long boxes of vinyl siding out to put on the forklift ... the forks that were out in front of it. And the last thing I remember was how much dirt there was on top of these boxes in this warehouse. You know, they had soot, you know, from I guess exhaust from the forklift machines and just the dirt in general being in the air, and birds in the rafters, you know, going on the boxes ... things like that. And I remember thinking to myself, this is disgusting, you know. But I was sliding a box over from this rack over on towards the forks of the lift, and that's the last thing I remember for 10 days. Somehow I catapulted from over the ... There were railings to protect you on this platform of the ladder. I somehow went over the side. I don't know how. And I don't remember. I still don't. And they found me on the cement floor in front of the forklift. And they called an ambulance and they shipped me down there to Brookhaven Hospital, which was the nearest hospital. I recall none of this. At that point, they had called my wife and luckily my wife works in the health field. And when she got there an hour after I arrived, they had me on a gurney in the corner, and they were just going to observe me for 24 hours. And my wife saw me, and she knew immediately that I had a fractured skull because all the blood from the internal bleeding had sunk down behind the eye

socket. It's what's known as a raccoon eye. So she saw that immediately, and she requested if the doctor had gotten a CAT scan and x-rays of my head. And he said, no, not so far. We were just going to observe him for 24 hours. And she said, my husband has a fractured skull, and he needs those things done immediately. And he apparently made some remarks ... I'm the doctor here. How would you know this? And my wife is ... She'll take charge when she needs to. She's not shy in situations. Thank God she knew what to do. So she told him to get moving immediately ... that it needed to be done, and she was going to make some calls. She works with a neurologist, who's her partner, and she called him. He was working at the U.S. Open at the time, and he had them run a 24-hour-a-day line down to him on the courts so he could be in touch, and he gave her names of certain doctors, you know, neurosurgeons to get in touch with out here. And so he gave her all the information possible and she did that. And then she went back and she had the name of a Dr. Santi, who was the neurosurgeon who was signed up over at Brookhaven Hospital. And the nurses told her ... Well, he's already ... He just left on vacation this morning. You won't be able to reach him. And she said, well, you don't understand. My husband needs him to operate. And they said, well, no, you don't understand. He's already left on vacation. And she said, well, he's going to have to be here. My husband needs him. If he's the best you've got here, he's gonna be the guy we need to do this surgery. I need his number please. So she finally found out his number and called him, and he came back to the hospital ... being a very conscientious young doctor from India. And he was supposedly the best there is in this area. And he came back and he performed the surgery later that afternoon. They had to do a lot of blood transfusions and so forth because I had five intra cranial bleeds going on, and the pressure was mounting, and they had to get the transfusions going and get the surgery going as soon as possible because it was reaching, I guess, critical mass at that point. So at that point they didn't ... The doctors told my wife that they really weren't sure that I was gonna make it through the surgery ... that it was a very serious situation. And even after the surgery ... I survived the surgery ... They said that I ... If I made it passed ... Now that was a Thursday. They said if I made it through the weekend, I could survive, but they couldn't say anything about my condition ... as far as mental or physical condition.

So then I was in a coma for 10 days, and I regained consciousness on ... It happened on the 4th of September 1997, early in the morning. And I regained full consciousness on Saturday, the 13th ... some 9 or 10 days later. And they didn't expect me to be physically adept or be able to move around. And of course, the first thing my wife asked them was ... Will he be able to play guitar? Because she knew that would be my thoughts. And they said, we can't ... We think he'll probably be in a wheelchair ... He'll probably be wheelchair bound. We don't know what his condition is going to be at all. We can't guarantee there will be any type of motor skills like that ... to say he'll be able to do anything ... we don't know. And so ... That's all. That's the accident, and then me coming back to it.

PP: Right. I can't even imagine what that was like. Uh ... When you regained consciousness, and you began to ... You know, let's say a couple of weeks later, or months later ... What were some of the ... Well, maybe before we get into that, when you say intra cranial bleeds. There were five of them. And you did fracture your skull. They eventually figured that out also. What part of ... Where physically was it? Left, right, front ...

LH: It was right here where you can see the scar here.

PP: Yeah, very slight. Yeah. So, right-sided.

LH: I had landed on my right side, so I had a skull fracture on the right side here. And I had dislocated my right shoulder and torn the rotator cuff and I had an enormous bruise on my right hip. I have photos. My attorney at the time took photos of it, but ... I have a bruise that covers the whole side of the hip. I guess it was probably some type of contusion. It was like some internal bleeding, but it wasn't real serious down there. I could walk later on. I haven't had much problem with walking. I've had a lot of problems with balance, which I'm starting to get better at now. And then the scar here is ... When they did the surgery, they had to go in and they had to cut what is known as ... in pretty kind of ... the first time I heard it I didn't like the terminology ... They make a flap, I was told by one doctor. They just go up here and

they make a train track, and it goes all the way back towards the back of the skull, and all the way around here. So this scar goes all the way around here. I'm glad the hair grew back to cover it. And then they peel that up and they ... There's like ... It's kind of like a bowling ball here. It's almost like finger holes that used to really bother me when I would feel it for probably the first year or so. And I think what they did ... I've never really asked for the details of it. But I think they had to drill in through the skull to release the pressure, first off, because that was building to a point of real serious situation ... the pressure inside there. Plus the bleeding. And then they had to insert some tubes to drain out the blood and try to stop the bleeding. You know, there's certain names for this, but I've never been able to remember all the names for the type of surgery it's called. So ... but if you need that I can get all that.

PP: No. I think it might be in your medical report. I'm going to have some physicians interpret it for me because obviously I don't know what I'm reading. They'll let me know what that means. Ok. Now, can you tell me a little bit about any kind of ... Obviously there were major changes in your coordination, your motor skills, whatever. Just talk briefly about that. What did you notice primarily?

LH: Ok. When I first started regaining consciousness, I had no knowledge, or I wasn't even close to any level of knowing what had happened to me and how serious it had been. As a matter of fact, that Saturday night my wife came to visit me and I asked her if she brought my jacket. And she said, your jacket, what for? And I said, well, I'm ready to go home. And I was still hooked up ... I was still in intensive care with 100-percent care all the time. There were three nurses who were there all the time with me. And they would come every hour on the hour to take x-rays and CAT scans and they would bring the machines to me. They didn't even move me. And I still had tubes in my nose and IVs and I had ... I think they called it a center line, or a middle line ... I don't know what that was for, but it was to keep all my vital signs ... the monitors ... that kind of thing. So I became excited and a little distraught, which I found out later was pretty standard for a brain injury because you have no way of knowing exactly what happened. There's even ... They've come to know

through studying brain injuries ... There's five steps ... Like you know how with grief, there's five or six steps of grief. There's five or six steps of coming out of a serious brain injury. And the first one is being really upset and distorted about a lot of things. I was so upset that my wife wouldn't take me home that night that I actually pulled the middle line out ... the center line, or whatever it's called. And one of the nurses was extremely upset with me about it. And then ... I apologized to her afterwards, and you know, they understood anyway. But that was one of the steps. And then, the next step is disorientation. And then there's the disinhibition stage, which I went through for a while, which was really ...

PP: Explain that.

LH: Well, the period of disinhibition is kind of being back at a certain young age where ... before you become an adolescent. When you're a child you have no inhibitions and you just go through life like everything is your new adventure. I was ... I don't know how long I was in the hospital. I thought it was only a few weeks, but apparently it was probably longer than that. Because there was just no time frame for me. It was all disoriented. And so when I was home after a couple of months ... and then I started going out. My wife took me out ... one of the first times she took me out, and I couldn't drive. I didn't drive for a year after this happened. But she took me ... She had to go to Northport to pick up some pictures she had had framed at a place up there for her new office. So I went with her and it was sort of an antique store ... You know, different curios and artworks, and they framed pictures of art. So my wife was doing business, getting these pictures framed, and approving them, and paying for them. And I was wandering around the store. And I found back in the antique section a little antique table with lips on them. It was a wooden table, and it had this box ... an ivory box with these black, like thumbprint type spots all over it. And I opened up the box and it had green glass marbles in it. So that's obviously what the prints were on the top. And I said, it must be for Chinese checkers or a game sort of like that. So I sat down and I just dumped them out. And they just rolled all over this table. And I thought, well, the lip would hold it, but two of them rolled off, and it was a very old plank-floored building, and two of them

disappeared. And the next thing I know there's a woman walking down the aisle with her arms folded in front of her. It looked like she was 10 feet tall to me. I felt like a child again. And I said, I'm sorry. I dropped a couple of them. I'll pick them all up. I promise. And she said, no, that's ok. And so that was one instance of it. The other one was that night on the way home. We stopped at a Blockbuster movie rental to get a movie out. And there were two young men working there and they were ... I guess they were Puerto Rican young men. They may have even been brothers, but they were dressed, of course, identical. The suits that they wear there ... the Oxford shirts and khaki pants. Except one young man had his head shaved ... freshly shaved. And the other young man had dreadlocks ... you know, like six or seven different colors ... from orange, red, to blue. And I looked at them and I was amazed at their two different looks. And I said, excuse me, can I ask you young gentlemen a question. And they said, yes, sir, what's that? I said, do you guys get your hair cut at the same place? And it was just like asked in that adventurous kid way. So, my wife started dragging me out of there. She said, come on, let's get out of here. I said, what's the matter? She said, Let's just get out of here. I'll tell you when we get in the car. And so she explained to me that she thought that they took it wrongly, what I said to them. And I said, oh, God, I'll go back in and apologize to them. And she said, no, no, no, don't do that. Let's just go home. I said, ok, but I'm going to have to call them and apologize when we get home. And she said, no, no, no. Remember you told me years ago, sometimes it's best to just let things alone that you really can't fix. And it's not really a big deal. She said, this is one of them. Maybe they won't understand and they'll take it even worse if you call and think you're a wise guy, maybe. I said, oh. Do you think this is that disinhibition that they were telling me about up in St. Charles Hospital? She said, yeah, I think it is. So that was disinhibition.

PP: So cool.

LH: It was pretty cool because it really helped me get through a very difficult time because I look back to that period now, and being in disinhibition was like being a child again. It was really ... it was pretty cool.

PP: It sounds like fun, actually.

LH: It was. It really was.

PP: What's the next stage after that?

LH: Uh. Gee, I forget. I should have gotten all the ...

PP: No, it's okay. I just thought ... It seemed like you were on a roll there.

LH: I forget them.

PP: That's okay. Um. Did you notice any ... Well, the accident happened very near your ear. Were there any auditory problems?

LH: Yeah. As soon as I came home from the hospital, I started noticing that I was having a serious problem. In conversation, if my wife or daughter would turn their face or turn their heads away in the room while we were in conversation ... Or if ... You know, like sometimes people in your family will ask a question or they'll be answering a question, and they'll actually leave the room or just go around a corner. They assumed, of course, that I would hear. And it was dropping out. I wasn't hearing the same as I used to. And after a while it was becoming a sore point because they didn't understand that I was suffering from a problem here, and I didn't even realize it at this point yet to explain it. So after a couple of weeks of this, it was becoming a sore point. And I explained to my wife, I said, I think I'm having a problem with hearing because when you turn your back or if you start to leave the room, it's just dropping out for me. I'm not hearing your words at all. So I had a hearing test at a place where I was going for some physical therapy at the time. And they said it doesn't seem like it's regular at all. It seems like you've got a problem. And they said ... They gave me some names of different places where I could go for a very serious ... what do they call it ... the serious test where you go

into a lab and they test your hearing. And St. Charles was the closest one so I went to St. Charles and the woman there was the head of the whole hearing and speech program at St. Charles — Karen ... can't remember her last name. And she told me ... After I described what happened, then she tested my hearing. And she said, you have pretty moderate to severe high-end hearing loss. She said, most of the people that I've treated in my career have been children ... very young children ... whose parents are just discovering, as they're getting to be a year old or so, that they have a serious hearing problem. And most of them have had pneumonia while in the nursery at a hospital. And when it's a life or death situation with pneumonia with a premature baby, they give them an extremely strong antibiotic, which is one of the strongest known to man. Unfortunately, it has a side effect of attacking the hearing nerves, and it destroys the hearing for a lot of babies. And a lot of the children who have hearing problems, that's what's happened to them. She said, did you have anything like that? I said, well, I did have pneumonia while I was in a coma. I developed pneumonia. And then I had a collapsed lung so they had to put a tube in ... a chest tube in. And they also gave me this heavy duty antibiotic to ... because it was a life or death situation. They figured with me already being in a coma with this injury and developing pneumonia. So she figured that's what happened.

PP: Ok. We were talking about the auditory. I think we pretty much covered that ... that you had some difficulty. Was there difficulty in both ears?

LH: It was bilateral.

PP: Bilateral. Ok.

LH: So ... then at that point, they realized that I was gonna need some assistance to hear properly, so I went back to the St. Charles Clinic once I started working there because ... What happened ... I had so much disorientation when I came home from the hospital. I was so happy to be home, and we had just moved into this house three weeks before I had the accident. So we had been in here three weeks, and then this happened to me. And I was gone for however long ... I don't know. So when I

finally came back, I was so happy to be home ... to be home with my family and in a new house ... and I still had a lot ... I was really disoriented in ways, and there were times when I really felt ... I would sit here near the fireplace in the daytime, and I would try to figure out ... make sense of things ... what had happened and why I was here and what was going on ... and I would ... I started praying a lot. I talked to my parents. My parents are both deceased, and I felt their presence here. It wasn't like anything spooky ... like they appeared. It was just ... I really felt the presence of my parents' spirit actually here. And I learned how much people really cared about other people and how much they personally cared about me ... from all over the country. There were so many blessings, so many well wishers, so many circles of prayer ... all kinds of things. I got mass cards from all over. It was really an incredible thing. But I was at the point where sometimes I'd be just fine, sitting here being thankful that I was alive and sitting in this beautiful house. And then other times I was only able to sit and cry because of my confusion. And then I woke up one morning, and Molly, our dog, was just a puppy ... because my wife figured it would be nice for me to have some company during the day ... being home so much. So we got this puppy, and she still wasn't quite house-trained yet. And I got up one morning, and the two cats were meowing to get out the door, so I went over and opened the front door for them, but I forgot to turn off the alarm, so the alarm bells went off. So then of course the people call from the service and they say, is everything okay? And I said, sure, yes, this is Mr. Hunter. Everything is fine. I just opened the door by accident and forgot to turn off the alarm. And they said, well, what's your password. And I couldn't remember it. My memory, of course, was suffering at the time. And I couldn't remember the password. And they said, well, that's how our system works, as you know. I'm sorry, but we'll have to send the police there. I said, well, that's okay. Send the police. And then I got off the phone and turned around and the puppy's over at this side of the house just pee-ing on the floor ... you know, which ... she wasn't house-trained yet ... At that point, I was just completely coming apart at the seams. I didn't know what was going on ... And I just started crying. I broke down in tears, and the police came. And I explained to them the whole story, and they were very nice. They were really understanding, and they asked if they could walk around and look at the house a little, besides looking to see that everything was

okay. I said, sure, go ahead, whatever you want. And they looked around and they said, you've got a beautiful house here. And I said, I'll figure it out. I will ... as far as the password. But they were real nice. And then after they left, I just broke down. I was in tears and I got a call from Dr. Sandberg, who was the head of the program up at St. Charles Hospital. And he said, well, you've been approved by the insurance and workman's compensation and whatever, to pay for the program here. And I'm calling to let you know, and you can start anytime. And he said, how are you doing? So I related to him what had happened so far that morning ... that I was pretty out of sorts and I was really upset. And he said, please, come on up here. We can help you. I know we can. We've got a good program, and we can help you feel better. So I said, ok, I will. I'll figure out how to get there. I can't drive, I said, but I'll figure out how to get there. And I did. And I started going there. And as soon as I was involved there, they took a whole history of what the injuries were. So they got me involved with the hearing and speech program again too. So I went back and saw Karen over there and she told me all about what was going on ... that I had this moderate to severe high-end hearing loss and that I would need to have hearing aids. And she said, what are your thoughts on that, because people always have a certain first response to that. I said, well, I would like them kind of small, you know ... the hearing aids. So it took me a year to get the hearing aids because it took them a long time to get them approved for paying them through workman's compensation ... because they tried at first to say that I had had a previous hearing problem. And I said, well, that's easy to find out, you know, because I took industrial hearing tests every year for all the years I worked at Georgia-Pacific. And they still weren't willing to pay for them, so I called the branch where I worked in Yaphank, and I asked them if they could send me copies of all the hearing tests that I had taken over the years. And they sent them to me. I took them to Karen at the hearing clinic, and she said, that's it, they're gonna have to pay for them. She said, it's like night and day ... a big difference in your hearing now. And I had a hearing test not too long before the accident ... within six months' time. So there was nothing that I was doing at that point in time. And I always used ear protection in an industrial area. Sometimes even driving a truck I wore ear plugs to protect my hearing. And I had

used these dynamic ear plugs when playing in a band for 20 years to protect my hearing. So ...

PP: Do you have hearing aids in now?

LH: Yes.

PP: Those are hearing aids?

LH: Yes.

PP: Wow. You'd never know it.

LH: Yeah, they're micro-sized, but most of them are made that way these days. It's a micro-chip inside. And it has a volume control ... on/off switch ... volume control there. The little battery goes in there, and there's a little chip down inside there. And they actually take a mold of your ear ... You know, they do a wax mold like for a tooth inlay or something. And then they make them exactly to fit directly into each ear. Each one is different. So it took about a year but it finally came about and I was very happy because it made a difference.

PP: Ok. You mentioned dizziness. Any problems with your vestibular system in terms of ...

LH: Uh. I had a pretty bad balance problem and ... which of course created a fear in me about falling because I certainly didn't want to fall again. So it held me back until very recently from riding my bike. When the accident occurred, I had been on a real serious health and getting-in-shape regimen for about ... probably close to three years I had been riding a bicycle every day for about 7-8 miles. I was in tremendous physical condition, probably the best of my life. And my wife being the health field has always been a tremendous nutritionist and health food knowledgeable, and that always transferred throughout the family, so ... my diet was incredibly good at the

time. I was in just tremendous condition. And they told me that was a wonderful thing that probably helped me recover as well as I did from the injury. But I had a very difficult time getting back on the bike, even though it had nothing to do with the accident. So after a while, I got the idea of getting a helmet. You know, they have the full, complete cranium cover like for racing ... you know, drivers wear ... so my wife bought me one of them. And I still really couldn't get back into it the way I used to because I was really into riding off road because I don't like to exercise. I've always thought it was ... running or riding a bike on the road is ... besides the possible danger of getting in an accident of some type ... is running behind cars that are emitting their exhaust all the time. It doesn't seem like a good way to exercise. So I was riding the bike in the Rocky Point Preserve a lot, and we have the five acres beside the house here, so I was gonna ride it here. And I still wasn't able to really get rid of the fear of falling and re-injuring myself because of the balance problem. Within the past six months or so, I've made great strides in regaining a lot of areas in my health. I feel a lot more confident about my balance. I've been working on my balance as far as standing on one foot and practicing my balance, even if I have the bed or the bureau there ... to know that I can grab it if need be without falling. I'm doing much better. I finally got off all medication, as of Memorial Day weekend ... because I guess it was just time because my body was starting to, I guess go toxic from the medication ... because I had started getting these welts and they were like raised up scarring type things all over. They started on my hands and on my right hand and arm, and I went to a dermatologist, and of course they give you cortisone-type things and it makes it go away, but it comes back fairly soon again, and it comes back even more angry and in worse condition. So I had talked to my neurologist about it and he said he didn't think it would be the medication, because I had been on it for so long already. And he didn't really think that that was a side effect of that particular medication. The medication, of course, was anti-seizure because I had had the seizures in the beginning. And so I went to another dermatologist who has got a great reputation in Suffolk County, and they couldn't find anything that ... They found a couple of things that I might be allergic to, but they couldn't really find the answer at all. And of course they wanted to treat it with heavy cortisone treatment, and I really didn't want to do that. I just wasn't

good to take that stuff or put it in your body anyway. And I had enough problems coming out of this, so ... I finally talked to my neurologist and I said, I really think this is ... By this time, going about a month into it at this time later, it had spread and it was going all over my body. I had these lesions all over and I felt like I had leprosy or something. So I went to see him a second time, and I just undressed in front of him. And I said, this has become a real serious problem, and you've got to help me. I don't know what it is, but I think it's the medication because they've given me the cortisone ... I tried that once, and it just comes back even worse. So he said, we'll try a change. There's another form of this medication. And so we tried that that following weekend, which was Memorial Day weekend, and it got worse. And I wasn't sleeping because I was itching in the middle of the night. And sometimes I would wake up and I would be out of control trying to keep the itch down, and it would just make the sores worse. So he finally agreed after Memorial Day weekend ... I told him, I said, it's so much worse, and I tried the change of medication. I said, I realize that it's anti-seizure, but I have to do something. You've got to help me. So he said, okay, let's take a chance. Let's pull you off all medication, and so I stopped it. And that was this past May. And after about a month, I was almost completely clear. I still have some basic discolorations of spots on my body, but all the lesions are completely gone. After about a month, they were completely gone. And there's been no seizure activity. And I didn't think there would be, and he really didn't either. But it was just playing it safe, even at that point in the game almost three years later. So it allowed me to feel ... After a month or so, I realized the lesions were going away, and that allowed me to realize that I was feeling, in a very subtle way, I was feeling a lot more like myself ... not that I ever noticed any side effects of the medication. I was never feeling drugged or anything like that. Obviously, there were some very subtle side effects to being on any medication, and I felt just a feeling of freedom ... of being free, of course, of having to watch it ... carrying little boxes with me and having to take them before and after each meal, and that kind of thing. And I've never been a pill taker. I never even took aspirin. I mean, even if I had a headache, I just really never took aspirin. So that was difficult for me anyway. So I've been feeling wonderful. It was probably a wonderful summer because half way through the summer, I got a call ... Someone

had referred my name to some people in Montauk who were putting on a stage show out there ... the Patsy Cline show ... and so I went and auditioned for that and, you know, got the job playing the guitar for the show and in the band for four weeks. And it was a wonderful experience because I had to do it on my own. My wife and daughter were busy doing things of their own, and I had to drive out there on my own, and be on my own in my life and do the audition, get the gig, and then come home and learn all the material, and then go back and play in the show on Friday and Saturday nights for four weeks. It did a lot for me ... a feeling of like coming back ... coming back to my life again. I'm off medication. I've done my first regular work in over three years, and it came out really, really well, and it was received very well, and I had a great time. It just really made me feel that it's time to start coming back to life again and it felt like the summer of my life in a lot of ways.

PP: That's great.

LH: And I've been starting to ride my bike again. I feel a lot stronger. I've been doing a lot more stretching. I'm not riding the bike a whole lot. I do have the woods here ... the five acres beside the house ... to ride in, which is a blessing, so I don't have to go out in traffic. And I have a great helmet, so ... But I'm feeling more confident now. I don't ride like I used to ride. I was kind of a dare devil when I was really in that fitness phase, and going through the woods ... But I'm feeling very confident and very good about things.

PP: That's great. Tell me about your vision. Any visual things happening after your trauma?

LH: Actually, that was one of the areas where I had no problem whatsoever. I didn't have any lessening of my visual acuities. I didn't have any problems with peripheral vision, as some people do after a brain injury or a stroke. As a matter of fact, an elder friend of mine who was in the hospital with me in St. Charles, he's 70-ish. Marvin is his name. He's just a very fine gentleman. He had had a stroke around the same time I had the accident ... maybe a couple of weeks before. And he recovered

from the stroke ok, but he was having problems with his eyes, and they told him, we're sorry to tell you this, but you'll probably never be able to drive again ... which was ... You know, he's a very active guy, and he had a small business on the side where he repairs clocks and watches, and he would go out in the tri-state area and pick up people's watches and clocks and take them home and fix them at his house and then re-deliver them in good condition. So that would put a damper on all that for him. So he didn't really accept that. He was hoping in some way that it would work out. And it did turn out. He's back in his life fully now, and he did have no peripheral vision for a while. It was just tunnel vision. But I had none of that whatsoever. It might have had to do with the fact that I've already had eye problems from very early on in life. I had eye muscle problems when I was 3 and had several eye operations, and I've always worn glasses. And I'm nearsighted. So I don't know whether that had anything to do with it, but there were no problems with my vision whatsoever.

PP: How did your memory hold up through all of this?

LH: My memory is getting better. In the very beginning, I had pretty severe memory problems. I mean I knew who everyone was. I knew who my family members were. And I could remember most people's names, except people I met new ... If I didn't really specifically make notes about things, I really wouldn't retain it. And I had a serious problem of being able to retain any information. I couldn't read because I would get like garbled up in the middle of ... after a paragraph or two. And I'm an avid reader. I read anything that I can find. I'm a big fan of The New York Times, of course, and I would ... The New York Times would come and I would try to read it with a cup of coffee, and I could get maybe a paragraph and a half into it, and I would realize that I wasn't retaining anything, and I was becoming disoriented about it. So I had to stop reading for a while. It went on that serious for about three months. I found around Christmas time of '97 that I was able to retain more of the reading. So I started reading a little bit at a time, and that started getting better. The memory was mostly a problem in my case in the case of lyrics. In all the lyrics I had written, once I started to try playing guitar again, which was another blessing ... I was rusty when I first started playing guitar again after I got home, but I pretty much

... The side of the brain that the memory was on, I was told ... There are two sides of the brain, and one side is all the automatic things, and the other is your learning process of how you learn things. I'm not explaining it very well, but they explained to me at the hospital that the reason that I could maintain playing guitar as well as I had in the past ... except for some rustiness, because I hadn't played for months ... was that the side ... I had been injured on the right side of the brain, and ... see, I can't remember these things they told me now. But if I had been injured on the left side, I probably would have had a severe problem trying to remember how to play guitar. As it was, the injury was on the right side and I was having trouble remembering the lyrics that I had written for years. And thank God I had written them all down. I have manuscripts ... tons of manuscripts that I've written lyrics in for I guess close to thirty years now.

PP: Are you right-handed?

LH: I'm right-handed, yes.

PP: Ok. Now I would have thought that it would be just the opposite, because the left side is usually for right-handed people the language center, where I would have thought the lyrics and things would have been stored. And the right side would have been the more free-flowing guitar-playing side. So I would have thought the opposite. I'll have to think about that.

LH: Yeah, I can't really give you an answer now because I forget exactly what they said, but it was explained to me a couple of times about how that could take place. Because I was very ... I was kind of scared about whether I was going to get the memory back because it kept me from even thinking about going out and performing at all, or even performing in front of anyone ... even my family and friends at home ... because I would start to sing a song and I would just go blank. I wouldn't even remember the lyrics. And I was the type that ... Right before I had the accident, I was getting into a regimen of ... Most of the work I was doing at that time was doing a single act, myself on guitar, or myself and a friend on guitar, and I was

doing all the singing. So I could get up and sing four hours and the only thing I would really have in front of me is a list of song titles, because I had them all inside of me. And all I would do is look down the list and count it off, and I would do the song. The lyrics would all be there. I would do things like ... I used to play one of the wineries out in Southampton pretty regularly for three or four summers, and ... The type of clientele that would walk in there ... They had a train running across the back so people would be sitting out there listening to the music drinking wine. The train would go by and I would immediately switch over to a train song. And a woman would walk by with her little shiatsu or special puppies trotting along, and I would switch around to "Hound Dog," and I would just go on rote and go through them. So that wasn't there at all. So I was kind of scared about that, and I just ... It took a long time for me to get that back. What really started helping me was a mutual friend of ours, Karen Sussman, because she suggested, while I was taking voice lessons from her, that I mark all the pages of my manuscripts ... you know with little colored markers for your schoolbooks ... and put the titles of the songs in there so it would be easier to find the songs because I couldn't remember where they were in the order of the book. And then she said, go home and pick out a song at a time, and read the lyrics and just sing it, reading your lyrics, until you feel confident, and then try and do it without the lyrics. And I would do this. As time went by, after a year of doing that, I started getting my memory back and ... Even in the studio, when I did the newer songs that I've just recorded, when I was doing the vocals, I had to have the lyrics in front of me, which is kind of an impediment to that free feeling of singing from your heart and soul, and just, you know, it usually comes with your eyes closed.

PP: Right.

LH: But ... I'm getting better. I've had some improvement there. The memory is ... I still get some glitches now and then of something that I can't bring up, but I've had vast improvement since the actual time of the injury. It took some time, but it's definitely improved.

PP: Your style of memory ... In other words, when you used to memorize a piece of music back before your trauma, have you changed the way you go about it, or is it pretty much the same, and you're finding that you're regaining your faculties?

LH: I feel that I'm pretty much regaining my faculties. I've had one person ... a guitar player friend of mine, Bill Frisby, who told me that he thought that my facility on the instrument is actually ... he thinks it's better now than it was before the injury. In ways, it might be. I feel that if it is, it's probably due to my ability to just feel grateful for being alive and still having the ability to be blessed with the talent that I have. I know the first time that I actually played in front of people or professionally was two years ago, when I was in a studio for the first time with a friend of mine who was recording his album, and I ... he was living in India, so he helped me to put together this session for him. So I hired the musicians and found and hired the studio for him, and then I was at the sessions with him. And he was driving me everywhere, and things like that, because I couldn't drive at that time. And he asked me to play some acoustic guitar parts, which I had helped him arrange. And I did them and I played one, and they said, ok, let's take a break now. And I said, no thanks. Let's keep it rolling. Next song. And just kept going and going because they wanted to take a break, and I said, no, keep it rolling. I want to play. Because it had been so long since I really played seriously, and this was all gonna be on tape. I wanted to hear how it came back because the tape never lies. But the most important thing was that I did five or six songs, playing the acoustic parts, and they were all in place, and they worked out very well. And I just remember ... after it was over, they said, okay, we're gonna have to stop now. That's enough. I just hugged my guitar and I broke down in tears, but tears of joy and gratefulness that I could still do this. I was so grateful. I felt so touched. It was so emotional that I could still play music and live my life and be here for my family and continue in my life. I just thank God for that all the time.

PP: That was beautiful. Tell me now ... Now we're gonna get out of the whole medical thing. Just tell me how you go about memorizing a piece of music. Let's say you had a ... maybe it will be more difficult in our conversation because you write your own

material, but if you had to ... Let's say it is one of your own ... it's a new song. How would you go about ...

LH: Well, I worked on the show this summer doing the Patsy Cline material.

PP: Ok. Did you have to memorize anything?

LH: Yes, yes I did. I had to memorize an entire show's worth of music because it was ...

PP: Oh, it was all by memory. How did you go about attacking that whole idea?

LH: Well, the first thing I did was ... As soon as I knew that I was going to go for an audition, I went to the library and I found a CD of Patsy Cline's greatest hits. I brought that home and I listened to that for a week incessantly, and played along with it. I knew most of the basic structure of the songs, and I was familiar with them, since they were all hits of hers, like "Crazy" and different songs like that, that were big hits when we were kids. But I just played along with it for the most part from CD and then I made notes on all of them ... different notes ... and I would sit and listen to different ... where there would be a guitar solo. And then I would sit down and I would memorize the guitar solo and learn it and play it over and over until I had those parts down. So when I went in the audition, I had a good touch with it already. And they just ... they said, how about if we just start going through it song by song, and we'll see how you sound along with the material. And they said, don't worry about reading or anything. Let's just ... We don't really have enough of the material. They had like three days until they were starting the show at that point. So I said, okay, I can go that way. I felt comfortable enough to do that. So we went through it, and apparently they were very happy and very pleased with me. They thought I was the man for the job, and they hired me on the spot. They said, are you interested in doing this? You know, and they wanted me to do it five nights a week, which I wasn't available to do. I didn't have the time to do that because I had certain commitments to my family here. I really wasn't ready to just jump and say, give them five nights a week. So I said I could do the weekends, the Friday and Saturday night shows. And they said that would be great. So they ... At that point, what I did

was I had brought a small tape recorder like this with me, which is ... I have with me all the time now ... I've been using that since the injury because it helps me keep track of things that I otherwise could possibly forget. So I taped the entire audition rehearsal and I had that with me. So I had that, plus I had notes that I had written as I was going through that audition, plus I had the CD of Patsy Cline's material. And then I asked if we could have one more rehearsal before I started. So we had one more rehearsal ... it was a dress rehearsal actually, the day of me starting ... that first Friday night. And we went through a complete rehearsal that day of the entire show, and I was pretty confident at that point. I had two weeks of solid work on my own, working on it at that point, plus the two full-length rehearsals, and all my notes. And my notes were pretty good because I had them all on big block letters I printed on legal pads, you know, and I kept them on top of my amplifier. And it worked out really well. The second night was better, and then the second weekend it was ... I felt really comfortable. And the fourth night, which was the second night of that second weekend, it was just fabulous. I was very comfortable after that. I did eight nights of shows, and as time went by, I got better and better, and I was playing more precisely the parts that I really wanted to play that fit, and I was taking out things that just didn't need to be there. And I started using a ... Being country music, it was really appropriate to have like the sounds of pedal steel, which has swells in it, but they didn't have a pedal steel guitar. They didn't have a budget for a lot more than they were doing. So I had a volume pedal, which provided the swells, and I would strike the strings on the guitar and give that sound. So I was able to bring that into the ... as a coloration to the music. So I feel as long as I'm able to work at it, you know, and I get that chance to work at it hard and work with my memory and make sure I have notes ... I did really, really well. I was very proud of myself, being the first work I've done in some time, being off the medication, the first work I've done after the medication ... It was a big step for me, and it made me feel really confident that I'm ready to go out and start performing. As soon as I have the CD done, I really want to start selling my product and selling myself ... so I'm ready to get back in the game. I feel real good about ... and I'm pretty much close to where I felt I was, you know, before the accident.

PP: That's so cool. Thanks. As you're memorizing a piece of music, we just talked about how the structure ... how you did it ... Pretty much you said it was repetition ... taking notes, that type of thing. Tell me how ... I don't know how to word this ... Think of like the elements of music ... rhythm, articulation, notes, dynamics, all that kind of stuff. Is there an order that you put that in when you're memorizing, or is it ...

LH: I would say, probably because of my orientation with all music, and especially on guitar, it usually starts with ... It's got to start with a chord structure, which would be rhythm on guitar. I've always been ... I started out being a strummer, which is a chord player, which is the basics of the instruments. And you have to know that to move any further than that point. So I start from there. I always ... I mean, I love to play solo and play melodic music on guitar, which I would with any instrument, but it starts with the chords, and knowing the chord structure, and where the movement goes with it. That's always first. From there it probably goes to the vocal ... From the rhythm to the vocal because ... I find the most comfortable I am in a performance is ... I play electric bass ... I'm very comfortable playing electric bass, but I find it very difficult to sing while I'm playing bass because playing bass is almost like a ... It's in part a percussive instrument, too, and time is everything with that instrument. And to sing a beautiful, flowing melody over the top of that is not an easy thing to do. I find it ... I'm much more comfortable, and it's always been this way, to play rhythm guitar and to play perfect rhythm, know exactly where the changes go and the timing in the whole structure and sing the whole vocal all the way through. I'm very comfortable with that. I never really started out to be like a lead guitar player, like a lot of kids, young people start guitar ... like they go right to step two because they want to be a lead guitar player. They want to be the star of the band ... out front, that kind of thing. And then they either have to take steps backwards to get back to learning basics of the instruments, or they don't make it. They don't become really versed well in the overall use of the instrument. I find that I never tried to be a lead player. But as the years went by, it became something that I figured I should become a melodic player too. And I've become very advanced at that. I don't really make that the main thing, though. I usually find a way to figure out the melody on the

instrument, also, besides vocally. But that's how it works for me. The rhythm structure, the chord structure, and the rhythm, then the vocal, then the melody ...

PP: How many pieces do you think you could play by memory if you had to? Like, say, oh, current. I know it's hard to say, but ...

LH: Right now, I would imagine ... I can say off the top of my head ... It feels good to say I could do an hour's worth right now without feeling uncomfortable. And I think it would just take doing it to improve on the distance, as far as going further than that ... at this point.

PP: Do you play different styles of music, or are you primarily like a folk player?

LH: I started out as a folk player. I play some rock 'n roll. I play ... probably more than anything ... I play a lot of blues. I've always loved the blues. I played with one of the blues originals ... a man named Floyd Dixon in San Francisco for a while. He wrote a song called "Hey Bartender," which was a blues type of hit. It wasn't a gigantic hit, but ... He was an amazing keyboard player and he was a very, very short of stature black man and his hair was processed ... they used to call it ... you know, able to comb back straight. He was very short. He was pretty quiet. And I auditioned for his band in San Francisco, and made it as a bass player. And so we did a couple of gigs, and we were gonna go out on the road. And I couldn't figure out how it was gonna work out going out on the road because I didn't know how it was gonna work ... this little man sitting on a big upright playing blues tunes and us being behind him. And when we first got on the road, the very first gig we played was in Santa Cruz, California, which was kind of like a hippy haven ... kind of beach town ... a lot of young people there. And I was figuring that they weren't gonna go for this. And we weren't ... I don't think we were four songs into the first set, and the entire place was up, and they had like ... People were holding on to each ... They were doing like a mambo train all around the place. And he had this presence where he would sit facing the side of the stage with his piano, and he would look over his left shoulder with a big white smile on his face, and he would be smiling and singing his blues

tunes. And the people were just nuts for him. They loved it. So it worked very well. And I became ... I guess, a student of the blues at that point. And I had already learned how to play a lot of acoustic blues things. And so, at that point, I figured electric blues was a wonderful thing to go. And over the years, I've played with this guitarist Jerry Miller, who was a wonderful musician. He was one of the finest guitar players I've ever played with. Of course, he played every form of music on guitar. He played a big L5 jazz guitar and he had wonderful tone. He didn't believe in any kind of pedals or noisemakers or changing the tone of the ... the raw tone of the instrument. And he just had this beautiful, old-fashioned guitar tone that had sustain, that had character, that had color to it. And he could play jazz ... he could play blues ... he could play rock 'n roll ... he could play folk ... he could play country. And I spent five or six years with him ... as a band mate, as a brother, as a friend, and as a student ... because he was an incredible musician ... that he was willing to share openly everything he had. And he was so gifted, and I learned so much about chord movement. I learned a lot of jazz guitar playing from him. And so I learned just about everything a couple of steps further along the way with him. And we did it all. We would do ... We had a band for five years. We did a lot of duo work in clubs and parties. And when we did acoustic guitars together, it would knock people out because they just didn't hear stuff like this that much anymore. So I play just about everything. I love really folky music, like country music, which is ... I feel that all indigenous music, like folk music and country music and blues, are all pretty much the same, and they just have a little bit of a stretching out of their horizons in different ways. But they're very simple structures ...

LH: So I started out playing ... Instrumentally I started playing acoustic guitar because I was in love with folk music. I was never really a big rock 'n roll hound. I was never really moved that much by ... like the 60s rock 'n roll. I was too much involved with Kingston Trio, the Brothers Four, the Limelighters, Peter Paul and Mary, Ted Mitchell and all the stars of that era in the folk idiom. They were just like ... It just had a real feel to it. That's where I started playing music. And it was really a lot of fun because there was so much that you could bring into it ... like the Smothers Brothers of course had ... they were two acts in one. They were the brothers who did

comedy, but they also were pretty serious musicians in the folk idiom. And we kind of brought that into our Millstone Trio, the first trio that I put together doing folk music. It all worked out really nicely and ... but of course I had the situation when I went to San Francisco of seeing folk music and acoustic music was kind of being left behind if you wanted to perform live. So that's how I got more involved in electric music. But I love playing the blues and I remember a guy said to me one time ... He said, oh, you're getting back to your roots. You're playing the blues again. And I said, if that's what you want to call it ... back to roots ... that's fine. But it's a pretty interesting experience playing with a man who's probably at least twice my age ... maybe he's three times my age ... I don't know how old he was at that time. I was in my 20s. And it's quite an experience getting to be involved in that. But around the same time, I met a man named Merle Saunders, who is a keyboard player on the West Coast, and he ... Merle Saunders was developing a big reputation because he was playing with Jerry Garcia of the Grateful Dead, and they had a band call the Legion of Mary ... It would change from month to month ... the title ... They had a bunch of titles, but it was all the same band. Him and Jerry Garcia and John Khan ... real good musicians, and they played everything from folky, blue-sy, traditional folk music ... because Jerry Garcia was crazy about playing banjo, playing slide guitar ... he played pedal steel. So they took all their backgrounds into that type of music they were playing. I knew Merle for several years before I found out that that wasn't truly his claim to fame. Only on the West Coast was his claim to fame playing with Jerry Garcia ... because Merle had lived for quite a few years in New York here, and he had played with Myles Davis and Lena Horne, Harry Belafonte, Johnny Mathis, the Crusaders, and ... Merle's biggest ... his competition in music was one character named Jimmy Smith. And they're both tremendously gifted B3 organ players. But Jimmy Smith was the guy who got the gigs. And so Merle eventually went out to the West Coast, but he's still a very dear friend of mine. He's played B3 organ on two of the songs ... the blues songs that are on this album ... and he is like a mentor of mine because between him and Jerry Miller, my guitar mentor, all the different styles of music that I saw were possible to just be a part of through these two wonderfully gifted, sharing, senior musicians who were way beyond me at the time that I met them. It was a real eye opener to really know

that music is just the name of the game as far as, that's all that really matters is the music. And it has nothing to do with ego, money or attitudes ... except for your attitude to just like play the music the best you can and share it as big as you can, as often as you can. And that's all that really counts. That's true. And I was given wonderful gifts by people that I've met over the years, and I guess there was something that I had to give them in return because everything is reciprocal in music. It's a real circle of life, and so I'm very thankful that I met people like that, and I've learned that it's a real cool thing to not box yourself into one area ... just stretch as far as you can. I've played a lot of reggae music. I love reggae. I love playing electric bass on reggae music because of the off times beats. And it's so much fun to play that different thing. I have ... partly through you and partly through the program at St. Charles Hospital when I was involved in the brain injury program there ... I learned a whole lot about Mozart. And I learned all about how incredible a genius he was and how much he left for us in this world in his music. And in so many aspects of it, you know, all the help that he's given to children that are in the book that you told me about, that I read. But also I learned that it could help me during times of stress and anxiety that I was going through during the healing process. ... that when I was dealing with things that were too much for me, I was overwhelmed ... I would put on Mozart and I would listen to Mozart and it was always able to just settle me down to a grounded, settling, relaxing place. And it never fails, and I still make sure that I listen to Mozart. So I really don't think there's any music that I don't listen to. I'm not real fond of rap. It's kind of a funny form of music ... It's more like poetry ... from a certain area that I don't really relate to. But I listen to everything there is to listen to as far as music, and I've tried to play most of it, and have fun doing that.

PP: Uh. Not a lot left that we ... Oh, here's some interesting questions. Some of the people I've been interviewing ... When I've asked them questions about memory ... One guy told me that he can see the music in his mind as he's playing it. Another guy told me that he's kinesthetic ... that he feels it ... he's a pianist, and he can feel what he wants to do. So it's that kind of memory that just goes straight from the brain to the hands. The other guy saw it. Another guy said he hears it right before he

plays it. So ... It's all very confusing to me, but is there one way that you approach that? Or is there something that happens to you in terms of assisting you in the memorization process, like that?

LH: Uh. I think it's probably a subtle combination ... I would have to describe it ... of memory, seeing it, and the feel of sorts. And the ears ... the hearing of certain things that I get attuned to. I find that now I've always been very aware of tone. With my acoustic instruments, I have gorgeous, really old acoustic guitars. So I don't have to worry about them in tone. As long as I'm playing the best I can, they have incredibly beautiful tone for the type of instrument they are. I have people with a lot of experience in studios come in the studio and they hear these guitars, and they ... You know, most of these are guys with a lot of instruments, with a lot of experience ... they've been doing this for years, and they're all saying, those guitars ... that particular guitar ... What guitar is that? That's unbelievable. And I'm using the best mikes in the world they have ... you know, Northern mikes, so they record them perfectly. But as far as playing electric guitar, I feel that I'm more in tune with the tone of the instrument being as pure, the raw instrument as it can be ... which comes down to doing a lot of reading and research on what that really was. Say ... Like this electric instrument of mine ... that guitar is almost 50 years old. It was made in 1954 by Leo Menner (???). And if you play it through a lot of modern amps, or you play it through an amp that's a solid state amp, it's got a very thin, reedy kind of sound, which is not very ... It doesn't have a soulful, full, rich tonality as an instrument. But it doesn't matter with country music. I can play it through an amp I have. Like the country music I played for Patsy Cline ... and it was perfect because it was that country music, twangy guitar sound. But I find that that's not my desire anymore. I want the guitar to play one note and sustain through an amplifier, give it that tone that sings that's full and rich and will have the full reach of the possibilities and the ranges of that note for tonalities, plus the natural harmonic overtones. And I find older style tube amps are the only thing that really does it. I've had the fortune to be working with G.E. Smith, the guitar player who is the head of the Saturday Night Live band, and he toured with Bob Dylan for 10 years. He was with other big name acts for years before that. He is the biggest student of guitar I've ever heard. He

grew up ... The first song he ever decided that he wanted to learn ... that he had to learn to sing and play guitar on ... was a Muddy Waters song called "You can't lose what you never had." And to hear him play that ... He needs that song as much as Muddy Water did it. But he's got better tone ... Because he's truly a student of the tone of electric guitar. And to listen to him play is just phenomenal. He's a gifted player acoustically and electrically, but it's helped me also realize the direction I'm going in ... as far as ... because it really helps me be a better player when the instrument is giving you the tone that my ears want to hear. And if it's a tone that's closer to a sustainable singing type of tone, then you don't have to work as hard, which means you can relax more and just play exactly what the song requires, and nothing more. I'm getting more feel. I have better feel as I relax more. So some of it is going from the brain to the touch also ... because I feel that I have a better, more fluid touch on playing melodic guitar than I ever have at this point. So it's a lot of what I've been listening to and what I'm shooting for as far as that pure tonality. But ... I always have in mind ... I think ... I've never really pictured it ... It's not like a staff showing in front of me with notes, but there's like a memory process just going through, telling me where the changes are ... naturally. What I just learned and what comes up next, and what I can do to reproduce a certain thing. I've been learning ... I learned a song ... You know who Stevie Ray Vaughn was? ...

PP: Yeah, I just brought back a CD to the library. Yeah.

LH: Stevie Ray was an incredible young blues player, and he was the meaning of blues for his time because he was helping people discover what it was really about. But he wrote a song called "Empty Arms," which to me is one of the purest blues tunes that's been written in probably more than 20 years, and it's got such a beautiful sliding tone to it ... [he hums it] ... I used to know how to do that before, but I didn't do it anywhere near as smoothly as I do it now. And I've got better tone doing it, which produces it better ... the better tone. And that to me ... It took memorizing that and then keeping that in memory. I guess what I memorize is the experience of the moment when I actually got that part down, or that piece of music down, and I'm able to bring that back to almost like a feeling of a spot in my brain that just

reproduces the feeling of that memory ... of that moment when I've got that down now.

PP: Good feeling. Yeah. Excellent. I think we're pretty much done. Are there any particular composers you enjoy listening to now?

LH: Well, Mozart of course. I'm still absolutely ... I can't not listen to Mozart. It just has really opened up so much of music for me. I also believe that it gives me a broader horizon as far as using the type of movements that classical music uses for the music that I write ... in that ... I know that when I was helping my friend Wayne do his album, he wrote a beautiful tune ... a song called "Love, do not deny me," or something like that ... just an absolutely beautiful song. And I heard a classical type of movement in the background. So I came up with a part ... I wrote a part ... I said, what do you think about this? And he loved it. It really fit the song. And it just brought out a little bit more of the song. You know, I didn't take apart the song ... now I'm part writer. It just helped the song speak a little more or sing a little more. But I feel in listening to Mozart, it has really helped me a lot through that. I like to listen to all kinds of music, and I like to listen to all kinds of songwriters ... all kinds of instrumentalists. I listen to Bela Fleck (???). Do you know who Bela Fleck is? Bela Fleck is the world's number one banjo player. But Bela plays everything on banjo. He started out playing ... His first big thing was ... He was with the Blue Grass Revival , and he played banjo like anybody ... you know, the great banjo players could play ... and do it just that way. But then the next time I saw him, he was playing with a jazz band he has. They're called the Flecktones. And he has this monstrous jazz band, and he plays jazz banjo. And then all the people involved with him ... like Sam Bush plays mandolin and plays violin ... what's his name, Mark O'Connor plays violin. Mark O'Connor from Nashville is going to be playing Carnegie Hall next month. So a lot of people are letting their horizons broaden and, you know, just discovering and doing different things. I love Yo-Yo Ma , and he has an album with ... There's an album with Yo-Yo Ma and Mark O'Connor on violin, who everybody knows Mark O'Connor as a fiddle player, but he's a violinist ... classically trained ... and a double bass player. And it's an incredible album ... it's all

classical stuff. And let's see ... There's a guy named [can't remember name] ... That's the biggest part of the memory thing that I still have problems with ...

PP: Oh, yeah, names ...

LH: Names ... and then if I try to bring it down .... Anyway, this man happens to be the finest ... what do you call it? Not pedal steels ... not slide ... It's the Dobro player ... the finest dobro player in the world ... Jerry Douglas is his name. But his first album that I have is just acoustic guitar and Dobro, and the feeling of all the different tunes ... They're all original tunes of his, and they go from country to blue grass, to classical, to Celtic music, to everything. It's just incredible. And the tones of the Dobro ... the way he plays ... He's unstoppable. There's nothing that stops his technique as far as the different types and styles of music. Celtic music I love listening to. Have you ever heard Clannad.

PP: I don't think so ... Yes, I have.

LH: Clannad ... They're a highlands family of singers and songwriters from Ireland. And they sing in the Celtic language. And they're ... it's very moving and it's incredible.

PP: My wife has some new Celtic CDs and things. I think that's among them. It rings a bell.

LH: It's wonderful. It's really wonderful. And I've got a whole bunch of them. But I have so much blues. I have a lot of blues stuff. And I don't always listen to blues. Sometimes, you know, it's great to listen to blues. But I usually have all kinds of different stuff on that I listen to. I like to listen to songwriters mostly from Nashville, as far as songwriters go. Because they really work on their art. And it's not so much as ... It's not so much that everything has to be a clever term or a phrase every time they have a sentence. There's a lot more people. There's a woman in Nashville who's had quite a few hits over the past 10 years, who had her first hit when she was like ... She was over 50 already when she sold her first song, which

became a hit. And she's become quite well known now. But they've branched out a lot. They've become broader in their horizons all throughout Nashville. The last time I was in Nashville, I went out the first night I was in town to two or three different places, and in one place ... of course they had a lot of songwriters and singer/songwriters, you know, strictly doing country music, and a lot of it was really clever terms and phrases all throughout the songs. And one guy I met there who had written my favorite song of that previous year was a hit for Tricia Yearwood. And it was a great song, and he was up there playing his songs. So I got to meet him. I talked to him afterwards and I bought him a beer, and we hung out for about 20 minutes, you know, and he gave me the same old shtick that everybody in Nashville does ... "You've really got to move down here and be here for about 10 years ... you know, walking the sidewalks and banging on doors, and stuff." I never knew whether Nashville was ready for me to do that. It's still down South in a lot of ways.

PP: It sure is.

LH: But I'm gonna go back there because I've made a lot of contacts there. And I definitely want to take my album there ... and see if I can sell a song, or make some sort of contacts ... see what people's interests are in the album, if at all. There's a woman in Texas ... She's looking over, or I guess she running her father's publishing company and all his copyrights on his songs. I got in touch with her through Warner Chapel down in Nashville because ... They were able to get me in touch with him because they knew ... which I didn't know at the time ... he was around 90, and he was dying of cancer. And I had written music to one of his songs because I found the lyrics to his song, and it was written in the '20s or '30s, and it's a real hillbilly, heart-break song ... "Are you satisfied now after breaking each vow? Have you found everything that you desire?" You know, it's a man singing about his loved one who left him. And it was such a heartfelt lyric. It was so real, and I could never find out who he was. His name was Ted Davin. So I wrote this three-quarter time music to it, and it worked. It was beautiful. I wanted to record it, so I started asking people in publishing down there, What would be the ramifications of me wanting to record this song? ... because I don't know ... I know who he is, but I can't

find out anything about him. I don't know what the music is, and I wrote a beautiful piece of music to it. Would it be possible to do that? Who do I need to talk to? And they said, just wait a minute, and they went into their computers and they looked him up. I went to ... I guess I went to BMI ... They had to bring it to a BMI building down there. They looked it up for me. They said, well, he was with Chapel Music, but they had been taken over by Warner. It's now Warner Chapel, and it's out of L.A. And I said, oh, I'm in Nashville. I don't know what I can do about that. And they said, Well, it won't be a problem because Warner Chapel has an office right across the street. And I said, yeah, but how am I gonna get in there? They said, Just take them this note and you tell them we sent you. I thought, Great. So I went over ... and you can always get in the door, but you can't get passed that unless you have an appointment or know somebody. And I said, well, BMI sent me over here, and they said I need to talk to someone who knows something about Ted Davin and his songwriting history. And they said, just a minute. Five minutes later ... Mr. Hunter, come back here. And this woman brought me in, and she had his account. She had worked his account for Warner Chapel for years. And she called down there in Texas to his family, and put me in touch with his daughter. And this was around October of ... I guess, '95, '96 ... And then .. that was '95, and then he died right around the beginning of the New Year '96. He died within a year. But I was in touch with her, and she sent me the sheet music, and she sent me tapes of him playing this song in the '40s. And she said, There's another song that I have of his that's called "Lost Highway," and it's a song that he wrote after he had been an alcoholic back in those days ... I guess in the '40s or so ... And she said, a lot of people drank a lot back in those days, and he got severely hooked. He had a problem with alcohol for a lot of years. He finally got beyond it, and he wrote this song about "Lost Highway" ... about being stuck out there ... the alcohol ... It's a great song. So she sent me that and she sent me an old publicity photo of him. And so then when I heard her father had died, I called her to let her know I had heard and to send my condolences. And she was very friendly. She said, Please keep in touch. She said, if you want to record my father's song with your music, go ahead and do it. Send me a copy so I can see what it sounds like. I told her I would ... I have part of it done now. I'm gonna have

to do it before I get completely out of the studio ... make sure it's finished and take it down to her. That's another one of those great experiences.

PP: It's amazing how it all works together.

LH: It truly is. It's an amazing gift in life.

PP: Well, thank you so much. I think we're ... we covered pretty much everything in kind of a roundabout way. But I think I touched on all of the ...

PP: Ok. I was wondering. One of the things that I was reading about that you reference a lot is the 12-point star. And unfortunately, the copy that I managed to clean off the Net was a little bit ... didn't print as clearly. Could you just briefly explain that to me.

PM: The term itself is a very general, symbolic term that can be applicable to a number of uses, you know, so it's not specifically determined with music itself and that alone. I remember when I was a child, my mother used to say when it was time to go to school ... I would be lost in lunch, and she would say to me ... "Look at the clock and see what time ... Don't you see what time it is? You're going to be late." And because of that, the clock was the enemy. It was the intruder. It was an abruption in terms of my enjoyment of that particular moment in my life. Um ... throughout my days I began to see an importance of lots of symbols around me that seemed to be separate from what I was committed to as an artist, which was music. And I began to see that the repetitive nature of symbolism throughout mankind ... in all of our cultures. And the clock is one of them. Having 12 numbers ... the same matches with 12 tones in music. Having north, south, east and west ... the same matches the matrix of a guitar's finger board, or any of the threaded instruments, you know ... or even the unthreaded instruments with strings that move vertically and horizontally simultaneously. Therefore, it was very simple to organize the clock itself in terms of musical tones in a 12-tone array ... so that 12:00, 3:00, 6:00 and 9:00 would be minor thirds of the ... a division of minor thirds in a 12-tone scale. You see ... seen in a circular context. Whereas 12:00, 4:00 and 8:00 would be triadic. They would be major thirds. You see. So here it's provided the neutralization of the difference between the two forms of perception. Now the clock, which used to be an enemy, is the same thing that I was interested in ... that it used to distract me. So it became unified as a whole. That's what the 12-point star is all about. It's the ability to see these standards ... these symbolic standards neutralized in a more unified whole so that 12 months of the year can also be seen in intervallic periods or intervallic divisions.

PP: Sure. So you look at the clock now as a ... more in a holistic way than in a subdivided way.

PM: Exactly.

PP: You use the subdivision when you need to ... to express the whole.

PM: Absolutely. The same thing applies to 12 apostles in the Christian, spiritual context. They too can be seen in symbolic context ... where you have the minor thirds form the plane or the perfect square, the major thirds form the triangle, or the pyramid.

PP: You get the Trinity out of that.

PM: Exactly. So there are many symbols that I find music being a universal language applicable to these symbolic forms. Literally they emerge into it ... like everything else in mankind, it is repetitive in the sense of simplicity.

PP: Exactly. Ok. We'll talk more about that. Um ... you mentioned someplace that you don't use ... or you don't think of key signatures ... that you think harmonically. Could you explain that a little bit to me?

PM: Well ... it's ... for me ... again, simplicity is the most important thing in my ... more or less to amplify ability on my behalf. If something is difficult for me, I'll find the simple part of that complex problem, and I'll try my best to reduce it to simplicity. A good example ... All that I went through with regards to recovery and ... at this point in my life, looking back upon those moments of crisis ... I could see that in a very pessimistic way, and say, "Wow, I really had to go through a lot, and I'm really lucky to be, and thank God it's all over, and now I'm living a more happy life." I prefer not to see it that way. I prefer to see that as a necessity ... to be here as I am in this present state of thinking ... of perceiving. You know. So I see that it a very optimistic way. That simplifies all of the problems that were involved in it.

I see everything as here and now, and everything that has taken place I see equivalent to the reason why here and now exists. So I'm more pleased. You know ... It's more pleasing that way.

PP: Right. That sounds very Zen-like, looking at your ...

PM: Extremely. Even though I have no specific interest in Zen, or anything else ... I'm more involved in a ... theosophically ... It's the addition of all of these factors as one.

PP: I read a Vietnam Buddhist by the name of Ticht Nant Hanh pretty much ... almost verbatim ... said what you just said about time and seeing things as unified whole.

PM: Sure.

PP: Ok. One of the things I was telling you before ...

PM: Forgive me for interrupting ... but I didn't answer your question specifically. You had mentioned about ... instead of key signatures, reducing it to a more totality along the lines of Schoenberg. As 12-tone, it's easier than memorizing prior to performing six flats, or five sharps. It's easier to see exactly what is needed when it appears ... the moment that it's needed ... for me personally. And I think that has something to do with the recourse of the operations themselves ... retainment was affected a great deal ... memory ... and to be able to hold onto these things. So it became a lot easier for me to do this with no sharps or no flats, as opposed to remembering somewhere down the line in the score exactly what clef or what key it's in.

PP: Plus a lot of your music ... I guess you would agree with me ... is modal and linear in some ways ... and there's not always a definite tonal base ... of if there is, it changes. Would that be another reason?

PM: Well, yeah, I mean there are times when I do use key signatures ... you know. There are some compositions that are in five flats. But maybe my choice for using that apparatus at that given moment was the lack of its use up until then. It felt pleasing in terms of change in itself. So I think these are very basic, raw, down to the ground, human tendencies ... you know, to fulfill upcoming needs when they arise. You have ways of amplifying your interest in what you're doing. So, uh ... And by the same token, you always have ways of minimizing any kind of restriction.

PP: I could see that. Yes. Um ... let's see. Could you explain your method of composition/guitar playing from the context of utilizing the various styles and synthesizing them. Like you went through an Oriental phase, should I say, back in the 70s ... and I've seen various styles ... On your latest album, I hear a little bit classical ...

PM: It's difficult for me to explain that in the sense of evolution ... primarily because it's not a format basis. It's seasonal.

PP: Ok.

PM: It happens again and again. There's a reimbursement of those interests when least expected. There's times of the year ... or the years ... where there's a repetition of something that I haven't done for a long time. In fact, recently, in 1998, I did an album called "Stone Blue," and that album came about because of an interest that initially took place and ended abruptly in 1976. So 23 years later ... 22 years later ... I suddenly had an interest in doing that kind of writing. So because of that, I see it as seasonal ... and not in the sense of an online, evolutionary series of events. So it's difficult for me to say how one changes the other because they never change. They just reemerge when least expected.

PP: Ok. Very interestingly, I see you use Macs as I do. And I've read that after your trauma you used the computer as a vehicle for your own rehabilitation. Could you explain the types of strategies that you employed using your computer.

PM: Um. I used the computer to avoid any kind of decisive moments where I chose to recuperate. I hadn't chosen to recuperate. I avoided the responsibility of recuperating. And I used the computer as a place to hide ... a place to ... it was a sketching board. It was a pencil pad for me ... where I could just doodle my thoughts and take my mind off of the pressures of my upcoming responsibility to rejoin life with everyone else. So the more I did that ... with the computer itself ... without knowing it, I became emerged in the process of technology itself. And it began to stimulate the same process that took place prior to the operations, and the recovery began ... unwillingly.

PP: Um hum. So at first it was kind of an escape, and then it became something more.

PM: Exactly. Because you must understand that the recovery itself was a period of boredom to the maximum. Prior to it becoming active on a creative basis, it was depression to extremes. And it was a very compassionate way of that fading away ... which I'm very surprised at. How it took place was out of my control. And I do think that willpower has a great deal to do with interest ... in terms of creative output. And the more interest there is when it amplifies, the more productivity takes place. And the more that takes place ... I think that's the greatest form of recovery there can be.

PP: Um. I've heard some of your interviewers mention that your approach to music ... especially the improvisational aspect ... has changed since your trauma. You've become a little bit more laid back ... someone described, and at the time you agreed with him. Do you still ...

PM: Well, if I agree with the statement that it's more laid back, I agree only because there isn't as much stress with regards to critique as there used to be. I'm not so

affected by opinionated statements coming from the industry itself. I'm more in tune with the facility itself ... the necessity of activating it as clearly and as fluently as possible when the time is right. Earlier, it was all the time ... to keep my chops up. You know the old musician statement. To constantly be on the edge of being right because someone may ring your doorbell at any time. I don't think that way anymore. I'm more involved in the moment. So maybe that's why I responded to that particular individual's statement at that time. It's a lot more relaxed at this point because I think it's more mature than just a career-oriented concern. I'm not so concerned about it ... although I am concerned professionally with all of the problems in the music business ... the industry whatsoever. But that really has nothing to do with daily living. When it activates, your concerns and your abilities activate along with it.

PP: I've heard you mention the phrase "colors of the rainbow" in a different context with respect to music and life in general. I'll tell you why I'm asking this question after you answer. Is there in your mind a correlation between the visual and auditory ... between music and color?

PM: Sure. Sure. Um. It's a general concern on my behalf, but in a broader sense, it's widened ... very much like your initial question about the 12-point star. The saturation of different forms of perception that goes into everything. It's amazing. It's really amazing ... how you can take ... a good example, not only with color ... and you can do it with color with all of the English words ... in terms of the alphabetic ... what it contains ... spelling. You could take any of those colors ... blue, red, green, the simple ones and the more complex colors ... I don't have one on my mind at the moment ... But you could take the 26-letter alphabet and place different scales of music against the letters themselves. If I were to take ... An example, a good example, was ... If I were to take the word "beautiful" and place that word under the alphabetic ... And under the alphabet, first and foremost, to place a C major scale, just for simplicity ... any of the exotic scales can be placed under the alphabet as well, in various orders. You then have the letters of the alphabet ... the first seven letters of the alphabet ... ABCDEFG ... would then

automatically return the tones CDEFGAB. You see ... and of course from G, HIJK, and so on an so forth. The next seven would be the C major scale. The next seven would be the C major scale. Then you would have five left for the full 26, from C to G. So Z would be G ... it's on G. You then take the word "beautiful" and the word "ugly," and you now can connotate what the outcome is going to be. The word "beautiful" is going to come up in tones as DGCBADABG. [He hums it] ... is the word beautiful. The word "ugly" comes up as BDED. It would sound [he hums it]. And what is missing is resolution. So now both words are accurately similar in terms of what they're producing as a positive result. And collectively now have a melody as an introduction to a longer event ... a composition in itself. But the composition didn't come from music, you see. It came from adapting several functions that are disregarded as having anything to do with music in most cases. So you see the colors are also effective in the same context. If there's meant to be included in terms of the architectural nature of the event.

PP: Listening to your interviews and getting a sense of the overall feeling that I get of Pat Martino, two words came to mind — wonder and awe. I know I'm inflicting my words on you, but do you agree or disagree with that in terms of your philosophy to both music and to life?

PM: I can't agree with it, primarily because of how important humility is to me. I don't think of myself in that way. Therefore, it's difficult to be able to understand such a compliment.

PP: Ok. How about in terms of your looking at the world.

PM: I look at the world in pieces. You know ... if I allow myself to. I find it more interesting and I find it more realistic to look at the world in terms of what IS at this very moment. This is the world. This is my life. This is my function. This is my responsibility. This is the source of virtue for me. This is the source of all of the values ... negative as well as positive ... for me, here and now. If I begin to concern myself with things out of reach for me under these conditions, it becomes a little bit

more difficult to understand the implications that arise from that. When I'm in public, and when I'm functioning in that context, these things come up of their own accord. And I act accordingly. But privately I focus on the very moment ... wherever I am. And that's what's difficult for me to understand ... awe and wonder. Because things are so basic.

PP: Right. Are you familiar at all with the lectures that Bernstein gave at Harvard in terms of his explanation of how music evolves?

PM: Not specifically. I've caught fragments on PBS at times. But I've never really studied the statements themselves in full.

PP: Ok. Let me just explain briefly. I'm just curious of your comments on that. He says in the beginning primarily ... and he's thinking all of the harmonic series, I think, in his mind in the background. He says that people ... either men sang or women sang, so there's unison. And he says eventually women and men sang together. And then you have the octave. Then in medieval times you had that fifth in there, and then a fourth, and then the third, and then you had triadic music of ... maybe the early classics. He's saying that as you go up, you eventually get to that seventh ...

PM: When you say as you go up, are you referring ...

PP: In the harmonic series. So after octave, then the third, and then as you go up you eventually get to that flatted 7^{th} note. And what he's saying is that as music has evolved, it seems to mirror the way in which the human race has evolved utilizing that. Would you see that as something that's plausible. Because I've read some people who disagreed with it ... his philosophy ... and I kind of adhere to it myself. But I'm just curious.

PM: It's still a bit difficult for me to understand the pinpoint of what you're presenting ... primarily because in terms of what the human race has chosen to do with music

in general, it's impossible for me personally to be able to come to a conclusion as to, you know, the evolution of its use. It's still, in many cases, primarily used for entertainment ... forms of entertainment. I don't see that as its sole proprieties.

PP: I think what he meant to say was that the harmonic series is built into nature. It's built into our very beings in the universe.

PM: Yes.

PP: What he's saying is that the human race virtually had no other way to do it because as we became more sophisticated, another step in the harmonic process automatically came ... like when we were ready to hear a flatted 7^{th} , then blues maybe came about. And then when we were able to hear that flatted 6^{th} , or whatever, ... you know, all these other tones and become more 12-tonish, is only when the human race was able to hear it and appreciate it.

PM: Well, it wasn't necessarily when the race was able to hear it. It's when the race finally came around to accepting it. It's finally when dissonance became consonant. You know. And that's something that is taking place at all times in life. You know, it depends upon the nature of the individual that's exposed to ... especially abruptly exposed to ... dissonance. And how many times this takes place prior to a decision to live with it ... is the first decision. To be able to live comfortably with it as part of your environment, instead of running away from it or trying to destroy its existence ... on behalf of your own privacy. That's up to the individual. And I think in many cases there's a relaxation to these events. The more they take place, the more they're accepted. And the more they're accepted and the more relaxed one becomes with it, one begins to take notice of things never seen at first, or never heard at first. And suddenly what used to be dissonant is now beginning a transformation toward consonance. And I think this is natural. That's a very natural thing ... in every way of living ... every walk of life. You know, it's like the employee who finds what the employer is doing is extremely detrimental to their position ... his or her position, and his or her comfort, and what's fair. And

then suddenly through the years, with experience, that employee becomes an employer in their own right. And they suddenly begin to see the responsibility that they were judgmental at. When they didn't have the experience to know what was demanded ... to appreciate it. I think of a parent and a child. So here you have the same thing. To the child, the parent is dissonant. To the parent, the child is consonant and always will be consonant. You know, so again, music is something that is a universal condition that melds with everything that can be perceived. And because of that, I think that it's difficult for me to give you a precise answer with regards to Bernstein, you know, and how I feel about what he had to say. My experience isn't that much in terms of those events. I didn't see those events, or read them, by the way. But I do think that dissonance and consonance that's ongoing at every phase.

PP: Now this is going to be a tough question. How different do you think your style would have evolved after your trauma if you didn't have access to like your old recordings?

PM: That's an interesting thing. You know. I didn't use ... It's been said in articles that I regained my playing by listening to my old recordings. And that's true. But I didn't personally choose to do so. They were part of the environment, since I was recovering with Mom and Dad. And my father chose to play them every Saturday, which in most cases I left the house and went somewhere until it was over, and came back. I didn't learn from copying my solos. They were part of the environment.

PP: No, I didn't mean copy. But as a general feeling for, oh, I used to do that. I wonder ...

PM: I really avoided that. I really avoided the records. I avoided the records and I avoided the guitar. I immediately got involved with music from the Macintosh computer. There was a little music system in it. And when I got away from graphics, I would then go to ... It was a series of boredom ... surges of boredom.

When I became bored with doodling with one graphic, I went to another. And music was one of them ... basic music. When I began to become stimulated by the computer itself, I upgraded, went to a higher computer, began to get software ... specifically musical software. That went in. There were always guitars all over the place. I finally picked up the guitar and began doodling on it, just like I was doodling with the computer. Again, to alleviate as much boredom as possible. And I would do that until I was bored, and then I would do something else. Always to put an end to the boredom. And that's what taught me the guitar. I think in terms of the similarities ... to stylish similarities ... I think a great deal of that is subliminal and was reactivated, and still is to some degree reactivated from time to time. And a lot more has reemerged than ever before. But re-attaining the abilities didn't come from initially what I used to do when I was younger, which was copy records. At that time it was Wes Montgomery, Johnny Smith, and others. A lot of, you know, the older, the way I used to play, came from subliminal reemergence.

PP: Um hum. It's just a part of you.

PM: Yeah, the more I did it, the more facility magnified.

PP: I'm curious. This isn't one of my questions ... but whether that was just an internal musical memory that just re-erupted.

PM: Well, I do think it was activated in terms of the availability of social interaction in that style ... in that way. The musicians that began to reemerge in my life were those types of musicians. I think that people in my business that were still waiting for me to play again ... to become active again in the business ... they were still the same business. I think if they were different people, different conditions in terms of relearning ... it would be totally different. But I think that had a great deal to do with reestablishing something that would be functional in what was available. So what was available was an old friend. And therefore what reemerged subliminally had a great deal to do with already what was learned to please those friends.

Maybe if that wasn't there ... maybe if it was different in a different place, something totally different would have occurred.

PP: Well, that's interesting because then those musical memories always reside in there. They say that the brain is very plastic in the sense that it can be regenerated ... rejuvenated ... and that memories lost can be regained by a certain stimulus in a certain part of a person's life, or a particular part of the brain. Very interesting stuff. Um. Could you tell me, what types of physical changes did you notice after your trauma?

PM: Physical in what ...

PP: Motor, maybe. Or either gross motor or fine motor ... I'm just trying to get a sense of that. Any kind of physical ... Did you limp? Did you have a weakness on one side?

PM: That's a very difficult question, primarily because there were other problems that were taking place during that same period of time ... physically and mentally. And I never really paid too much attention to whether or not I was limping, you know. Um. But I do ... I can bring this to your attention. Due to heavy smoking during that period in my life, emphysema took place. So in terms of limping, there was a great deal of loss of function ... for different reasons. Totally for different reasons. So I don't know. It's difficult to really put a finger on exactly what the source was for these problems that were coming up. I mean, it's amazing the change of the years.

PP: Oh, I know.

PM: It's really amazing.

PP: While I was reading about your ... the whole process ... I'm amazed. Um. Did you perceive any auditory ... I don't want to ask you the same types of questions, but

I'm curious if you noticed any types of ... Why don't I just ask you a general question, and you can answer it and get it over with. Any kind of changes at all in ... I'm not talking immediate ...

PM: I remember changes ... for instance ... in my right wrist. Carpal tunnel syndrome began to govern my condition ... my physical condition. I went to a specialist at that time, and he suggested surgery on both arms, which would place me six months per inoperative (???) I decided to go for a second opinion, and I was given electric tests. I forget the type ... what it's called ... where there are pads placed on you and you're given jolts until you reach a limit in terms of how much you can handle. That particular specialist brought to my attention that it was up to me to make a decision, and he advised me not to have any surgery done. But to do the best I possibly can to take my mind off of these problems and to take a look at a long-term change over a period of time where I really took my mind off of the problem. That's the last time I had any trouble with it. I just disappeared. The lumps that I had on my wrist just evaporated and went away. So they were psychological problems. So there were a number of things of that nature that did take place.

PP: Oh, boy.

PM: There was a period of time when I had trouble with nasal arteries that led to a great amount of bleeding. It had to be cauterized again and again. For what reason I have no idea. One period of time in 1987 where I was headed to Duquesne University in Pittsburgh for a symposium ... I almost bled to death in Pittsburgh. The symposium was canceled. I rushed back to Philadelphia on a flight after I was at Pittsburgh General Hospital. This was on a Saturday. The surgeon that was specializing in that particular form of surgery wasn't available. He was on the golf course. So someone at the hospital ... an intern ... took care of the cauterizing ... cauterized it one more time and I made back to Philadelphia. That was taken care of and the problem ceased. But I almost died in Pittsburgh in terms of hemorrhage ... internal hemorrhage. So that was another event that I can't really describe and

come to a conclusion as to what caused it to take place. I was in terrible condition in terms of weight. I don't know what to say. Many things were in action.

PP: All at the same time.

PM: Yeah, all at the same time. Recently I came back from Paris and I caught pneumonia. I almost died recently. I went down to 86 pounds. I was in the Jefferson Hospital. They were going to transplant both of my lungs. It was a terrible time. I made a decision at the end of that period through a very close friend who advised me to get involved with yoga and also with certain forms of nutrition ... juicing and, for instance, water, like wheat grass ... and I've been on that. And recently I gained something like 60 pounds. I'm at 155-160 pounds now. I'm feeling great. My breathing is fine. They took me off of the transplant crisis list. So everything has again transformed. So your question is an interesting question, with so many facets of ...

PP: I didn't realize there were all these underlying things happening.

PM: Oh, yeah. Absolutely.

PP: I'm sorry to bring them all up.

PM: No, in fact, I'm happy to share this with you. You know.

PP: I'll be talking to five other musicians who have had some kind of trauma, so I want to see some similarities. So I hope you don't mind me asking you this.

PM: Not at all. It brings me back to what I said at the conclusion ... that it's difficult for me to see any of these particular things as ... in a pessimistic way. Primary because the outcome is extremely optimistic.

PP: Well, I understand that for myself philosophically, but I certainly fall into that woe is me thing in my own life.

PM: That's a choice. That's a personal choice.

PP: I'm trying to get over that. We spoke about memorization a little bit before. Can you just briefly tell me ... If you have to ... If you're gonna perform someplace and you've just written a couple of new pieces, how would you go about making sure you had those ingrained before you performed them?

PM: I have a music stand on stage with it written out.

PP: Oh, you do? Ok.

PM: After the operations, when I got involved in music again around '87, which is around the time of Ethel's, I began to always have the music that I write before me on the music stand. Recently, in '98, it hasn't been that necessary, but I still have stands there. I still to this day take advantage of that if necessary.

PP: I don't do the kinds of things you do, but when I perform I find that I need the music there, but I rarely look at it. It's just, I guess, a confidence thing.

PM: Sure. Sure.

PP: Before your trauma, did you have stands present also? Or is that just ... a little bit of the confidence thing also? You just don't want to take the chance.

PM: I didn't ... Well, I wasn't able after the operations. I had no retainment. And it was impossible. I'm getting better and better in terms of that. I really work hard at memorizing at this point in my life ... reactivating that. It feels great ... better and better.

PP: If you find yourself that you're going to memorize something, how do you go about it? Just give me a little idea.

PM: I give it priority in terms of what it means to me. The same thing with numbers. I immediately memorize my cell phone numbers ... my bank account numbers ... my social security number ... all of my fax numbers ... my e-mail numbers ... my manager's numbers ... his fax numbers ... his cell phone numbers ... his e-mail numbers. These things are priorities because they're in function on a regular basis. The same thing ... I see no difference where music itself shouldn't be just as fluent and just as easy to absorb and recall. I think that I didn't consider music a priority for a long period of time, and even though I wanted to participate at the highest level, it was necessary for me to have it written out because it wasn't a priority internally. So I think it's up to the individual's priorities.

PP: When you do attempt to memorize, do you see it visually or do you hear it auditorially?

PM: I hear it. I hear it more than see it.

PP: And when you ...

PM: And that's a priority as well. Melodies are essentially magnetic. They will remain in you if they have any value as melodies to begin with.

PP: Very true.

PP: We're almost done here. Talk a little bit about the whole idea ... I'm intrigued by the concept of confidence and your living in the present moment.

PM: Did you say confidence?

PP: Confidence. Yeah. In both your ... in life in general and of course in your approach to music. Can you just tell me a little bit about your philosophy of that.

PM: Well, you know. I can be specific with regards to performance vs. preparation for performance. You know. It's an easy thing to pick up an instrument ... whatever that instrument may be ... prior to its use, and be under the impression that a period of preparation or practice in the sense ... an ironic word that has two meanings contained within how it is used. Practice can be the equivalent of a student. It can also be the equivalent of an attorney or a physician. So it depends upon how it's used. I know that in the sense of preparing for a performance, the more I would pick up a guitar and try to strengthen my hands, the old word "chops," the more comfortable it would be in terms of being provided with the security that I have these "chops." But the moment that I would go on stage or even go to a rehearsal with a group of other performers, there were no chops, primarily because there was ... When doing that privately and intimately, there was no pressure placed on it in terms of interacting with someone else ... at tempos that were governed by mutual interaction. You know. So it made me believe that suddenly, while practicing was different than what I thought it is, it doesn't really prepare me the way I thought it would for performing live. So it reduced itself to the very same thing that terms were created for the computer. It reduced itself to the division of either step time or real time. And step time was practice and preparation for an event, and real time was the event. I come to find that there's a brief period of confrontation in real time prior to the event, and that is at the rehearsal and maybe a small period during the event itself ... during the performance ... the initial moment. There's a feeling inside. You know. There's a worry before coming on stage ... which is normal for the greatest virtuosos there are. So I say to myself, then this is quite an illusion ... to practice is quite an illusion. So why should I worry and why should I literally create the anxiety that is so devastating in terms of the endeavor itself and the temperance and endurance. The anxiety that's created really inhibits all of that. So at this particular point, it doesn't bother me anymore. I get to the rehearsal and I still confront myself and I feel the anxiety when I'm there. And it causes me to do the best I possibly can, under any circumstances. And that really gives the energy,

and that really gives the fuel for precise technique. It really clears things up in a very fast moment.

PP: I remember when I was at Berklee, someone asked ... I don't remember who it was ... It was a saxophonist ... very famous. He said, how long do you warm up before you go perform? The guy looks at him, and says, "I never stop playing, man. I don't have to warm up." Interesting answers. Very good. Really, I think that's about it. Oh, just one other question. I find that some of the people I've been talking to ... I have interviewed now about a dozen "normals" who have not had any kind of trauma, and they talk about ... well, some of them have ... the kinesthetic, the feel of a run or the feel of a particular key ... like when memorizing a piece or when composing a piece. Do you have any ... Do you feel things kinesthetically either playing the keyboard or your guitar? Do you find a kinesthetic memory that you rely on? G flat run ... I can do that because I know it.

PM: Well, no, I don't ... not when it comes to improvisation. That's always spontaneous. But in terms of the structures ... the architectural structures of what's setting up the themes, in many cases the themes that I write are ... they're dividends from improvisations ... whole improvisations. And they do contain ... they do embody certain physical positions that are memorable. You know. And maybe it's that ... the fact that they are memorable that they feel right ... that I could maintain that. And prior to the performance that's what I retain more than anything. And that particular composition obtains that solidarity ... through that.

PP: I just interviewed a bass player who does Broadway type jobs and he was saying that he ... I lost my train of thought. Hang on a second. I must be tired. This bass player was saying that if he does a jazz gig or a club date or whatever, and a tune he doesn't know, he'll learn it in all 12 keys.

PM: That's interesting.

PP: Yeah. I've never even thought of doing that. I've been gigging since I'm 16. And I thought that was just incredible. I never thought to do that. And it's a very obvious thing, but yet I never thought of it. Do you ever approach something that way?

PM: No, I've never found it necessary to memorize something in all 12 keys. I do find it necessary, though, to ... For instance, when I'm going to be recording as a side man or even ... well, not so much as a leader, because normally as a leader I write all of the music that I'm going to record. Or production-wise, I'll choose what I'm going to record as well. But as a side man, or a featured artist, the first thing I do is ask the leader of the project to send me some scores on what we're going to do. Because I dislike walking in at the last moment and sight reading something with no familiarity in terms of the topic of this conversation. So that's as close as I can get to what this bassist would choose to do ... to go through something in 12 keys. I'll go through something in the sense of some literature sent out just to ...

PP: I'm not sure if he memorized things. He just wanted to get so familiar with the piece and its changes and harmonies and textures that he would sometimes write it out in all the keys.

PM: There was only one time that I was forced to have to do that, and that's when I was working ... I was playing with Sonny Stitt in the early years of the '60s. And whenever we would play a duet, which would be guitar and alto, such as *Lush Life,* Sonny would come in every night with a different key ... call it in a different key. And then I did. I had a concern for that. Whether it was Sophisticated Lady or Lush Life or one of the others ... Lament ... It would always be in a different key every night.

PP: That's interesting.

PM: Yeah, so I guess I was really concerned about it in those years.

PP: That's funny because I was hearing one of the Rolling Stones who would just show up at a Chuck Berry gig every so often, and they'd always do the same kinds of pieces. And he'd look and something's wrong. He'd say, "I'm doing it in A tonight." He would just switch keys on him and not tell him.

Well, thank you so much. I think that's about it.

Interview with SC

PP: Ok. Today is October 7, 2000. I'm talking with Susan. Could you just tell me briefly about ... You've had two traumas, one in 1969 and one in 1991. Could you just briefly explain what happened to you?

SC: In 1969 I was hit by a car and after that I received ... I don't know exactly what happened ... as far as where I landed, but I know I must have landed at one point on my head because I did receive the head injury ... which about six months later, I started getting petit mal seizures. So I had to go on medication for that when I was 13. And ... um ... that was the first thing. I outgrew that, which at lot of times adolescents will outgrow things like that. And so by the time I was 18, I was off any kind of medication to control seizures. And then I sort of lived my life. And then when I was 35 I was married, and my husband and I wanted to get pregnant, and the doctors were afraid that the pregnancy would instigate seizures. And so they put me on a medication as a preventative medicine for if I got pregnant ... so it wouldn't hurt the fetus. And that medication ended up making me very depressed, and I ended up getting carbon monoxide poisoning. And from that I was very severely injured. I was in rehabilitation for two years straight after that. And that's been a much worse kind of a head injury. I didn't even think I had a head injury from the first one. I did have symptoms of it, but people were not as educated about what they are. You know, when I would be spacey and would forget things, and people just thought I was being a spacey chick or something ... and I was able to ... When you're in high school, you're not graded on just one thing. You're looked at as a whole child really. And since I was so good in the arts and in music and in math, I could ... My grades were still really good. Where I had problems was in reading comprehension ... if it was your typical, for instance, your typical SAT question would ask ... would have you read a whole paragraph and then you'd have to remember it. That's the kind of thing I had trouble with. But my overall testing was still very high, so ...

PP: May I ask how you got carbon monoxide poisoning?

SC: Um. I think I was very ... I was having a lot of problems and I was very depressed, and it just totally did a number on me. And I don't think I really wanted to die, but it was a ... whatever they call that ... just a call for somebody to help me. I was seeing a doctor ... a psychiatrist ... but I wasn't really getting help. And, um, anyway ...

PP: Ok. You don't have to go into it. Um. Ok. Could you tell me some of the changes that you noticed after the trauma? For instance, did you experience any auditory difficulties?

SC: No, I never had any trouble hearing. I never had any trouble even recognizing anything in my long-term memory, even from the beginning. Jim would visit me in the hospital when I was still in intensive care, and ... or maybe not intensive care, but when I had a private room ... and they had a TV in my room, and they were showing Amadeus. And I knew everything, and I was telling him this is Salieri and ... So I was able to remember my long-term memory, and musically I've always been able to do what I always did.

PP: Um hm. So you can still play ... like piece that you used to play?

SC: Yeah. I never ...

PP: That part was never ...

SC: Yeah, it never ...

PP: That's great.

SC: Yeah. Thank God. And for the first two years I was going to a rehab that was in Manhasset, which is the town where my parents live, so I could live there ... so my quality of life was much better and much more enriched because I had the piano at my parents' house ... and later they paid for me to be able to go to a gym. So I was getting a lot of ... I had read somewhere that once someone becomes head-injured,

they really need to go through their whole developmental process and try to experience things ... you know, in terms of ... crawl around ... see what it's like being a kid again. And do all those things. And swim. And do as many sensory-type things. And so physical exercise was certainly that. And it was also difficult just ... It was a fairly big gym, and it was a big cognitive exercise just remembering what the rules were ... where everything was. And I would get lost. Now when I've gone there it's not ... I understand the layout of it. But originally it was just one incredible maze where I was just like ... I had no idea. And my sense of direction was totally off. And I would often get lost if I was going someplace new on the road, or whatever.

PP: Any visual difficulties after ...

SC: No.

PP: How about short-term memory?

SC: No. That's what it is. It's all short-term memory. And it's also probably some reasoning skills I think were ... because I'm sure that there's a lot of ... When you reason, that's a high-level thinking process. And there were things that were missing. And I know ... for instance, in the beginning I was very concrete and I couldn't see any subtleties in anything. Maybe musically I could, but that was a totally different thing. But when it came to life, everything was black and white.

PP: Right. And do you know which part of the brain was affected, let's say, by the first one?

SC: No.

PP: You don't know what side or anything like that?

SC: No. I'm sure it was all ... When I was hit by the car, I was hit on my left side, but I was thrown into the air, so it could have been the right side of my head. On the

second one, it would have been everything because your breathing would have gone to ...

PP: Right, right. Oh boy. Before we go too much further, I forgot to ask you about your ... Just give me a brief synopsis of your educational background.

SC: Ok. I have a bachelor's from Westminster Choir College in church music, and I have a master's in music education from Post. And after that I went to different schools and I got various credits, so I got up to like 40 additional credits after that.

PP: Wow.

SC: I love to learn.

PP: I know. I'm the same way.

SC: And so ... You know, when I first started ... When I changed my career from being a private piano teacher into being a public school teacher, I took ... I would take a three-credit seminar and like a week-long thing in a certain discipline, and another three credits in this ... And like I took a lot of the Orff workshop courses, and I took the Long Island Recorder Festival workshops. I took dance ... folk dance ... international folk dance. And so it was interesting. I think the things that I tend to like to do were really good for my head injury rehab as a child. And I was ... I was active in a lot of different things. I always did plays. I was always singing. I was always playing the piano, and I was always writing plays. And that is whole-brain, and so anything that's whole-brain is really good for rehab.

PP: Absolutely.

SC: And, um, and so luckily my interests led me down that road, you know.

PP: Very good.

SC: But now I know that I've leveled off in certain ways ... as far as my short-term memory. And all I can do now is sort of hone my compensation skills. Although even then they sometimes don't work.

PP: Yes, well I can imagine. That's why I carry this around with me. Tell me about your memorization process ... if you had to memorize a piece of music. Tell me how you go about that.

SC: Well, Dr. Bottazzi taught me a lot of ways to help with that. And I was studying with her before I had my second head injury. So it was interesting to see how that process helped me before the really traumatic head injury ... the second one. A lot of what she taught me was motor memory and just going through phrases and using different rhythms to just get them into your fingers so you can just sit down and play almost without really processing what you're doing. Your hands just do it. Your whole body just does it.

PP: Letting it flow, right.

SC: Yeah. But I would go through ... I was always interested in analyzing the chord structure and the whole structure of the piece form-wise. And so I would always do that. And I always knew where it was going key-wise, and things like that. So I think that really helped me a lot. I was probably ... you would say I was pretty scholarly about how I memorized things.

PP: So you might take a piece of music and look at it harmonically?

SC: Yeah.

PP: Would you do that?

SC: Yeah. Like ... in a sonata form ... that's pretty clear what's going on there. But in the development, you know, things get a little bit more hairy. So ... when I was memorizing ballads and etudes by Chopin, that was ... A lot of that was ... I mean there was still your basic overall harmonic structure to it. And ... but all the stuff that was like the filigree was ... That was just all finger ... motor memory.

PP: Motor memory. Um. Do you have perfect pitch?

SC: Um hm.

PP: Ok. Do you use your ear when memorizing? Like how does the ear fit into that?

SC: Um. Well, I know if I'm playing the wrong note. [laughs]

PP: You don't really use like an auditory memory in a sense.

SC: Well, when I'm trying to remember something that ... Like if I'm in the middle of playing something, I can hear where it should go, and I can see, you know, the notes that I should be playing next, kind of thing.

PP: How about visual memory? Do you ...

SC: Yeah. They call it topography ... where you're looking at black-white, black, you know, on the notes ... that kind of thing?

PP: Oh. I didn't think of that, but that's ...

SC: I did a lot with that. That helped me a lot.

PP: Explain that to me. That sounds very interesting.

SC: Um. Well, you know that you're going to get to a certain place, and you might have two black notes, two white notes ... how far they are apart ... that kind of thing.

PP: Oh. So it's really a part of motor memory, but in a visual kind of way.

SC: Yeah.

PP: Ok. Wow. My original question, though ... I speak to some people ... one guy was a conductor, and he said he could see the page in his mind as he's conducting. Do you see the piano music when you're playing? Or that's not a part of how you approach it?

SC: Um. I don't think I ... I think I could see it. I mean, I don't think I took time to focus on seeing what the notes looked like, because I would look more at what it looked like on the piano. I mean ... I can see why a conductor would really need to see it on the page because there are so many different parts, whereas I don't think I do.

PP: Ok. Thinking of the elements of music. Is there an order that you memorize in, or is a whole-thing-at-once kind of approach?

SC: Well, I think in the key first. And then the meter ... definitely the meter.

PP: Right off the bat would you worry about articulation and dynamics as you're memorizing? Or would that come later?

SC: Um. It depends. On certain parts I might try to get that in my memory right away, you know. Certain things in Bach ... they just automatically ... you're off a certain note ... and I would approach it ... Like Bach is sort of simple if you're thinking in terms of the way I was taught it. Um, you know, the portamento kind of touch or the more legato. And I think that I never really analyzed that. I know that having worked with Dr. Bottazzi, she also told me to ... whatever I did with a piece, do it all the opposite way, and don't get so caught up in one way to practice something. But that

was, I think, for your motor memory. Like if something was supposed to be legato, do it staccato, and vice versa ... because that would really get it into your ... You would really know it then.

PP: Yeah. That's a wonderful technique. She described that to me on ... when I interviewed her the other day.

SC: Ah ha. And she would also have me do just different rhythms with everything.

PP: Right.

SC: And that was ... That's very helpful. And I think it gets you past ... You might get hung up on a rhythm for a phrase but if you're doing a totally different rhythm, it doesn't bother you. And then when you go to the regular rhythm, it happens.

PP: It just flows. That's great.

SC: Yeah, I think she was the one that devised that. I don't think she got that from any of her teachers.

PP: That's an excellent thing.

SC: And you can ... I'm sure in any other instrument, you can apply it too.

PP: Oh, sure.

SC: I mean, even in a whole band ... you know, if they can't get like a dotted rhythm, or ... you know, do it backwards.

PP: Which my kids would be able to do. [laughs] Did you teach before your trauma? You said you were a teacher.

SC: Yeah. I taught private ... Well, my first trauma I wasn't really teaching. I was a child. I was only 13. But I started officially teaching when I was 18 ... just privately. And then when I got out of college, I was teaching a lot ... and also leading choirs in churches. And it wasn't until years later ... I was married to Jim, and I met some of his teacher friends, and they said, oh, you ought to work in a public school. So that was when I went back and I got my master's for teaching in the public schools. I can't remember ... What was your question about?

PP: Whether you taught prior to your trauma. Do you still do anything with that?

SC: I've taught privately and I've done okay. I've even had a student go to NYSSMA (New York State School Music Association) and get a great rating. I probably scribbled all over her book because the adjudicator said, oh, boy, you have a great teacher, you know. But ... what was the rest of your question?

PP: You pretty much answered it. How about performing?

SC: I don't feel as comfortable performing all in memorization as I used to. I think I always got a little nervous about my memory, though, because of my first head injury. One time ... I've had a seizure when I was performing. When I was in high school, I used to accompany the choir ... and one time I had a seizure in the middle of that. And I was able to ... I don't know what I did, but I could do a little bit of improv and I knew chords and so I could just sort of fake it, and nobody knew. You know. I knew because I was like, oh, my God. But I think that I ... I don't think I really want to perform without music in front of me. So I'm more of an ensemble player now than I was. And I have performed since then in ensemble in churches. And I've played in some of Jimmy's recitals, and some of Michelle's recitals, too.

PP: Now in terms of the way you ... We've talked about how you memorize music. Has that changed since the trauma? In other words, if you think about how you used to go about memorizing pieces early on as compared to now, is there any change over the years that you've developed?

SC: Oh, definitely. Because I think that I wasn't as ... When I was younger, I didn't have a problem with it. It just happened. I would just play through a piece and not really think about it ... and not really be conscious of it. And now I have to be really conscious of what's going on, and I have to be thinking of the harmonic structure ... and sometimes the phrasing will help me to remember certain parts ... or the touch. So that's changed.

PP: Right. If you're distracted when you're memorizing something, do you find you have to start at the beginning or can you start where you were interrupted?

SC: Um. It probably depends on the piece.

PP: Right. Sometimes ... If you had to choose a number in the amount of pieces that you can play from memory ... I mean not in a formal type of situation, but if you sat down now at that piano over there, how many do you think you could rattle off?

SC: Um. Well, since I haven't really played classical pieces in a while, I probably couldn't rattle off too many. I could probably play "Jesu the Joy of Man's Desiring." I could probably play some of the easier pieces that I taught my students. I don't know if I could get through an invention. I know I couldn't get through any of the Brahms or the Beethoven pieces or the Chopin.

PP: If you had the music, though, you could probably ...

SC: Oh, yeah. Playing with music, I could play it. But ... yeah ... my memory ... Yet if I was trying to do something a whole lot simpler that didn't involve so much piano technique ... I could probably figure out or play a hymn, you know, something much shorter and concise in form.

PP: Ok. Very good. Do you play different styles of music?

SC: Well, I play like gospel and I play rock and roll, and a little bit of jazz and classical.

PP: If you had to memorize a piece in one of those other genres, would it be the same process that you talked about before? Or do you approach different styles differently?

SC: Well, the simpler styles, I think are not a problem at all. You know, when they have a simpler chordal structure where it doesn't even really matter what exact notes you play as long as you're playing the chords ... the right notes and the chords. Because the thing is ... that's not really ... you don't really know whether you're playing the same notes. So as long as you can get through the piece okay ... but it's not the same exact thing. So I wouldn't have trouble with that. But if I had to something exact, I probably couldn't. You know, it would be harder.

PP: That's good ... a good answer. Um. Ok. I have some questions here about confidence both in memorizing a piece and in performing a piece. Could you just talk about that for a minute.

SC: My confidence went way down once I had the head injury. And although I think I was never really that confident, compared to some people, because I started taking ... Well, I had lessons when I was younger, but then I stopped because my teacher moved away, and then I had another teacher. And then it wasn't until I was I guess in my mid-20s that I found Dr. Bottazzi. And she taught me things that had I known ... had I applied those things to my playing when I was younger, I would have had a lot more confidence as a youngster, and then I wouldn't have had ... I just probably wouldn't have been as nervous. And since I didn't have that to help me ... and don't forget, I had a head injury since I was 13. So I had problems with memory that I didn't really acknowledge. Because everyone would say, well, you have epilepsy, but they didn't say head injury, and they didn't say, as a result of this, you're gonna have memory problems. I didn't know. And the teachers never said anything, because I still was a high ... I did high grades and stuff. And I used my creativity to work my way around any kind of problem I had scholastically. You know. I remember that when I ... This was like in relationship to my first head injury ... On the English

Regents in 11th grade, they said, write something about a book, and I just totally froze. I mean, I had read lots of books, but I couldn't remember anything. And so I just wrote about ... which was something that was in my totally long-term memory ... I wrote about something from the Bible. And ...

PP: That was fine.

SC: Yeah. But, you know, that was sort of a way of working around ... It was sort of working around what everyone else was doing. And so, in a way, sometimes I think my creativity hurt me ... in a sense, like, if I wasn't so creative I wouldn't have been able to just pick things ...

PP: Oh, I see what you're saying. But you're also so bright that you're able to compensate, which is the name of the game, I think.

SC: Yeah. I guess. But I think I felt my sense of ... my self-esteem went really way down after my first head injury. Because all of my friends were, you know, high ... were high marks ... and they went to great schools and ... 700s and 770s on their SATs ... and I couldn't pull that off. And so ... you know. So I think that for me my head injury really did a number on that ... self-esteem. Whereas, like Dr. Bottazzi, she just kept fighting. But she had ... She was given such a healthy self-esteem from her family. You know, they really ... they were always praising her. And they also gave her the tools of what she needed to be an incredible success from the time she was 2.

PP: Well, they sure did. She gave me a whole run down of the story ... plus I read the book.

SC: Yeah, *To Live Again.*

PP: What a great book.

SC: Isn't that beautiful.

PP: She was so surprised I was able to find a copy. She said, where did you get that?

SC: What, you found it in Hewlett-Woodmere?

PP: No, in Kentucky.

SC: In Kentucky?

PP: I put on the Internet search. I had three companies searching the world for this book. And all of a sudden I get an e-mail from some guy in Kentucky that said, I think we've found one in a discarded public library. I said, how much do you want for it? He said $5. I said, send it ... do you have two?

SC: Did they?

PP: No, they just had the one. But I've read it over and over again. I was just amazed by her.

SC: Yeah.

PP: What kind of ... Who are your favorite composers? Let's go back before the brain trauma. Who were your favorites from growing up?

SC: My favorite composers growing up ...

PP: To play ...

SC: I always loved playing Beethoven. But when I was younger, I mean, I would play these easier versions of it in these method books. But I always liked Bach. I always liked Beethoven. I liked the Bs ... Beethoven, Bach, Brahms ... I didn't really like

Mozart. I loved Chopin. As a child, I was only playing a few of his waltzes ... nothing really too difficult.

PP: How about now? Has it changed, or is it pretty much the same guys?

SC: Um. Well, I love them. I love Scriabin. I didn't even know Scriabin.

PP: I was just going to ask you about Scriabin.

SC: Yeah. I didn't even know him until I was in college. I love Debussy and Ravel. I got into them later. I've played the Gershwin preludes.

PP: Oh, those are so hard ... some of them.

SC: Well, I didn't think of them as hard. They were just something I did.

PP: Right. Before we talked about pieces you could possibly play by memory, or at least if you had the music in front of you. What are some of the names of those that ... if we had the books here ... what would you rattle off for me?

SC: I could probably play the first two movements of the Moonlight Sonata. I could probably play any of the sonatas that I've played.

PP: The Beethoven ones?

SC: Yeah. A number of the Mozart sonatas from the Heiden. A bunch of the Chopin waltzes and Mazurkas. Some of the Debussy preludes. "Clair de lune" by Debussy. I did a lot of the Brahms intermezzi and I did one of his rhapsodies. Dr. Bottazzi had me doing a lot of Chopin, though. Because so much of piano technique comes from that. I never really did any Liszt. I did some Satie. That was ... everybody wants to play ... "Pavanne for a Dead Princess."

PP: That's great. I think we're pretty much done. Oh. Are there any ... Do you have any recordings or anything that I could borrow ... of you playing?

SC: I don't know where it is. It's someplace in my mother's basement.

PP: I don't want you to go crazy over it. It's just a question. Ok. I guess we're done. Let me just look over my notes.

Appendix-C

Interview Questions-Pilot Study (excluding questions regarding trauma)

The Interview process and questions described below are based on a semi-structured interview style and format. It is imperative to the process that the interviewee be allowed the freedom to define and explain the terms of their "world-view" in their own vernacular. It was the interviewers task to use the following questions in an effort to obtain an understanding of this view in an informative dialogue. These questions are designed to be open-ended and are skeletal, thereby making them a springboard from which the interviewer will create individualized questions as the interview progresses. The questions were not necessarily asked in sequential order.

Introduce myself and explain that my research concerns the brain and its ability to process music.

Purpose: To examine how musicians with and without brain trauma utilize musical memory and to find the similarities and differences in the way musicians use their musical memory. There are no right and wrong answers to my questions. I will ask interviewees to answer the questions to the best of their ability.

How do you memorize a piece of music? What are your strategies?

When thinking of the elements of music....is there an order in which you would ordinarily memorize them? (The elements of music usually discussed are notes, durations, rhythms, form, melodic contour etc).

If you are distracted or interrupted during the memorization process...describe to me how you would get back on track. (Discuss the types of distractions are more likely to create diversions to getting back on track. Examples primarily are background noise i.e. spoken word or music (external); thoughts (internal)).

How much of a musical phrase is attempted at a time?

Do you play different styles of music?

Do you memorize in different styles of music?

How much time do you allow for memorization?

Do you find it easy to memorize? (Discuss different types of musical pieces, which would be appropriate to the level, and expertise of the subject).

Are the methods of memorization the same for each style?

How often have you performed from memory?

How many pieces can you perform successfully from memory?

How would you rate your success at memorization?

How important is confidence to your performance ability?

How do you view the concept of confidence in your ability to memorize?

Can you tell me the titles and composers of the pieces you can perform from memory?

Describe for me the difficulty of the pieces, which you can perform from memory. (Discuss the integrity and difficulty levels of pieces....should there be a question. This information can be ascertained by the composers and titles. If the piece is unfamiliar a copy will be procured),

Do you feel confident in your ability to perform from memory?

Where have you performed?

How often have you performed by memory?

How often do you perform?

Interview Questions-Subjects (including questions on trauma)

The interview process and questions described below is based on a semi-structured interview style and format. It is imperative to the process that I allow the person to be interviewed the freedom to define and explain the terms of their "world-view" in their own vernacular. It is the interviewers task to use the questions found below which will lead to an understanding of this view in an informative dialogue. These questions then are designed to be open-ended and are skeletal, thereby making them a form of springboard for the interviewer to create individualized questions as the interview progresses.

The subjects are in various stages of rehabilitation. The subject may be apprehensive about answering questions regarding trauma before a comfortable relationship is established with the interviewer. Therefore the general questions may be asked first.

Introduce myself and explain that my research concerns the brain and it's ability to process music. I am examining how musicians with and without brain trauma utilize musical memory. My purpose is to find the similarities and differences in the way musicians use their musical memory. Therefore, there are no right and wrong answers to my questions. Please answer the questions to the best of your ability.

Would you please describe for me the nature and severity of the trauma you have sustained. (The sophistication of language used will be age appropriate).

I am particularly interested in the level of self-knowledge and awareness of the injuries sustained. (These questions are concerned with physical changes, which may have occurred post trauma. Motor difficulties are those that include fine and gross bodily movements, i.e. Legs, arms, fingers, etc. Auditory refers to the hearing apparatus. Was there any deficit notices in hearing words, pitches, timbres, etc. Sensory refers to any of the five senses. Were any changes noticed in the tactile, olfactory, etc? Other general changes refer to any physical changes not mentioned in the other questions).

I'd like to ask you about some of the changes you may have experienced after your trauma.

Did you perceive any motor difficulties?

Did you perceive any auditory difficulties?

Did you perceive any sensory difficulties?

Did you perceive any other general changes?

Tell me about the rehabilitative measures that have been taken thus far.

Has your daily routine changed since experiencing your trauma? If so..in what way?

Did you memorize music prior to trauma?

How easy or difficult was the memorization process for you?

Has your taste in musical style changed since your trauma?

Can you still play pieces that you learned prior to trauma?

How do you memorize a piece of music? What are your strategies?

When thinking of the elements of music....is there an order in which you would ordinarily memorize them? (The elements of music usually discussed are notes, durations, rhythms, form, melodic contour etc).

If you are distracted or interrupted during the memorization process...describe to me how you would get back on track. (Discuss the types of distractions are more likely to create diversions to getting back on track. Examples primarily are background noise i.e. spoken word or music (external); thoughts (internal)).

How much of a musical phrase is attempted at a time?

Do you play different styles of music?

Do you memorize in different styles of music?

How much time do you allow for memorization?

Do you find it easy to memorize? (Discuss different types of musical pieces, which would be appropriate to the level, and expertise of the subject).

Are the methods of memorization the same for each style?

How often have you performed from memory?

How many pieces can you perform successfully from memory?

How would you rate your success at memorization?

How important is confidence to your performance ability?

How do you view the concept of confidence in your ability to memorize?

Can you tell me the titles and composers of the pieces you can perform from memory?

Describe for me the difficulty of the pieces, which you can perform from memory. (Discuss the integrity and difficulty levels of pieces....should there be a question. This information can be ascertained by the composers and titles. If the piece is unfamiliar a copy will be procured),

Do you feel confident in your ability to perform from memory?

Where have you performed?

How often have you performed by memory?

How often do you perform?

Sample of Cover Letter Sent to Health Care Professionals

Date

Michael Jones, M.D.
55 Residential Drive
Deer Park, New York 11729

Dear Dr. Jones:

I am presently pursuing my doctorate in the field of Neuromusicology. My research is in the area of brain trauma and its effects on the long-term memory skills of musicians. In order to thoroughly explore the impact that brain trauma has on a music professional, it is necessary to gather interested candidates who would consent to a qualitative interactive study. The privacy of all subjects will be held in strictest confidence.

I realize that you are unable to provide me with names and other information of potential subjects. What I am asking is that you post the enclosed "Call for Participation," in your waiting room or other public area where patients can view it. You may also give it/send it to your patients who you feel might be interested and qualified.

This project is in its earliest stages of development. If you have an interest in this topic or know others who may wish to help, I would appreciate a call or e-mail. Thank you for your time and consideration.

Sincerely,

Peter A. Pece
Address
City, State Zip Code
Phone Number
E-mail Address

SUBJECTS NEEDED FOR STUDY

STUDY IN NEUROMUSICOLOGY
COGNITION: MEMORY

Qualifications:

No age restrictions
Have had any brain injury/trauma
Have had formal musical instruction prior to trauma
Will need cooperation of people who were familiar
with your musical ability prior to trauma

Questionnaire and interview process will be held at your convenience and at a location of your choice.

For further information please contact:

Peter A. Pece
Phone Number
ppece@suffolk.lib.ny.us

Thank you for participating in the first part of the interview process. With your assistance it should prove to be enlightening and beneficial.

The personal information asked for in the attached questionnaire is for my purposes only. Your identity will be held in the strictest confidence.

The reason for this study is to examine the effects of brain trauma/injury on the memory skills of musicians.

In order to understand and achieve a clear understanding of what you experienced personally, it will be necessary to contact those who know you, your medical situation, and your musical ability before and after trauma/injury. Therefore, please understand that I will in most situations contact those you name. The conversations held with these individuals will only concern your musical ability. Nothing of a personal nature will be discussed.

Should you find any of the questions not pertinent to your situation, or that you do not feel comfortable answering, please indicate by writing N/A.

If there are any questions regarding this questionnaire please contact:

Peter A. Pece
Phone Number

I thank you for your time and truly appreciate your participation in this study.

Name _____ Date of Birth _____

Address _____ Phone _____

_____ Male _____ Female _____

Ethnicity - Afro-American _____ Are you right-handed _____

Asian _____ left-handed _____

Caucasian _____ ambidextrous _____

Has this changed? _____

Hispanic/Latino _____ Marital Status (please circle)

Native American _____ Married Single

Other _____ Widowed Divorced

Name of Family Doctor _____ Phone Number _____

Address _____

_____

Names of specialists knowledgeable about your trauma/injury

Name _____ Phone Number _____

Address _____

_____

Name _____ Phone Number _____

Address _____

_____

Name _____ Phone Number _____

Address _____

Name _____ Phone Number _____

Address _____

Names of Family Members Relationship Phone Number

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

9 _____

10 _____

	School Name	City/State	Music Teacher	Phone
Elementary				
Jr. High				
High School				
College/Univ.				
Graduate				

Please list friends who are knowledgeable of your musical abilities before trauma

	Name	Phone Number
1		
2		
3		
4		
5		
6		

Please list friends who are knowledgeable of your musical abilities after trauma

	Name	Phone Number
1		
2		
3		
4		
5		
6		

Please list educators who are familiar with your musical abilities before trauma

	Name	Phone Number
1		
2		
3		
4		
5		

Please list educators who are familiar with your musical abilities after trauma

Name	Phone Number
1	
2	
3	
4	
5	

What is your primary instrument? _____

When did you begin your primary instrument studies? _____

What other instruments do you play? _____

Did you play your instrument up until brain trauma/injury? _____

If you have taught students privately, please list. (Parental permission must be given).

Name	Phone Number
1	
2	
3	
4	
5	

What was the date of your trauma/injury? _____

What type of trauma have you suffered? _____

Do you know what part of the brain was affected? _____

October 1, 2000

I hereby agree and with full consent give my authorization for you to release medical information regarding my condition to Peter A. Pece. Thank you for your cooperation. If you have any questions regarding this letter, you may contact him at (631) XXX-XXXX.

_____

Name

Please send information to:

Peter A. Pece
Address
City, State Zip Code
Phone Number
E-mail address

April/May 1998

Dear Parent/Guardian:

I am currently pursuing my doctorate in the field of Neuromusicology. My research involves the study of traumatic brain injury and its effect on the memory skills of musicians. I will therefore in the near future be interviewing musicians who have experienced some form of TBI. To prepare for the interview of these people, I would like to conduct a pilot study where I would speak with others who have studied music and who **have not** experienced TBI.

I have randomly selected your son/daughter as an interviewee. The process would include a questionnaire, and an interview or two which will be audio-taped. The names of the interviewees will not be made public, and nothing of a personal nature will be discussed. The interview will be on an individual basis at your family's convenience, and will not disrupt your child's school program.

If you approve of your son/daughter's participation in this project, please sign the form below. Thank you for your consideration. Should you have any questions regarding this letter or the study in general please feel free to call me at (phone number).

Thank you.

Peter A. Pece

_____

Signature of Parent/Guardian

Citations

ABEL, T., and KANDEL, E. (1998, May) Positive and negative regulatory mechanisms that mediate long-term memory storage. **Brain Research. Brain Research Reviews,** vol. 26 (pt. 2-3), pp. 360-378.

AIELLO, R. (1994) Music and Language: Parallels and Contrasts. In: AIELLO, R. and SLOBODA, J.A. ED. **Musical Perceptions,** New York, Oxford University Press. pp. 241-288.

ALAIN, C., CORTESE, F. and PICTON, T. W. (1999, August 2) Event-related brain activity associated with auditory pattern processing. **Neuroreport,** vol. 10 (pt. 11), pp. 2429-2434.

ALAIN, C., WOODS, D. L. and KNIGHT, R. T. (1998, November 23) A distributed cortical network for auditory sensory memory in humans. **Brain Research,** vol. 812 (pt. 1-2), pp. 23-37.

ALAJOUANINE, T. (1948) Aphasia and artistic realization. **Brain,** September; vol. 71, pp. 229-241.

ALKIRE, M.T., HAIER, R.J., FALLON, J.H. and CAHILL, L. (1998, November 24) Hippocampal, but not amygdala, activity at encoding correlates with long-term, free recall of nonemotional information. **Proceedings of the National Academy of Sciences of the United States of America,** vol. 95 (pt. 24), pp. 14506-14510.

ALONSO, R.J. and PASCUZZI, R.M. (1999) Ravel's neurological illness. . **Seminars in Neurology (Supplement 1),** vol. 19, pp. 53-57.

ALTENMULLER, E. (1986) Brain electrical correlates of cerebral music processing in the human. **European Archives of Psychiatry and Neurological Sciences,** vol. 235 (pt. 6), pp. 342-354.

ALTENMULLER,E., SCHURMANN, K., LIM, V.K., and PARLITZ, D. (2002) Hits to the left, flops to the right: different emotions during listening to music are reflected in cortical lateralization patterns. **Neuropsychologia,** vol. 40 (pt. 10), pp. 2242-2256.

AMADUCCI, L., GRASSI, E., and BOLLER,F. (2002) Maurice Ravel and right-hemisphere musical creativity: influence of disease on his last musical works? **European Journal of Neurology,** vol. 9, pp. 75-82.

ANDREWS, J. (1995, July) Starting from scratch: guitarist Pat Martino (Interview). **Down Beat,** vol. 62 (pt. 7), pp. 36.

ANDREWS, J. (1998, October) Stone blue (sound recording review). **Down Beat,** vol. 65 (pt. 10), pp. 51-82.

ANDREWS, J. (1998, October) We'll be together again (sound recording review). **Down**

Beat, vol. 65 (pt. 10), pp. 51-82.

ANDREWS, M. W., DOWLING, W. J., BARTLETT, J. C. and HALPERN, A. R. (1998 September) Identification of speeded and slowed familiar melodies by younger, middle-aged, and older musicians and nonmusicians. **Psychology and Aging,** vol. 13 (pt. 3), pp. 462-471.

ANVARI, S.H., TRAINOR, L.J., WOODSIDE, J., and LEVY, B.A. (2002, October) Relations among musical skills, phonological processing, and early reading ability in preschool children. **Journal of Experimental Child Psychology,** vol. 83 (pt. 2), pp. 111-130.

ARDILA, A., MONTANES, P. and GEMPELER, J. (1986, September) Echoic memory and language perception. **Brain and Language,** vol. 29 (pt. 1), pp. 134-140.

ARKHIPOV, V.I. (1998, September-October) The retrieval of attention-dependent long-term memory traces. **Zhurnal Vysshei Nervnoi Deiatelnosti Imenti.P.Pavlova,** vol. 48 (pt. 5), pp. 836-845.

AROM, S. (2000) Prolegomena to a biomusicology. In: WALLIN, N.L., MERKER, B., and BROWN, S. ed. **The Origins of Music**, Cambridge, The MIT Press. pp. 27-28.

AYOTTE, J., PERETZ, I., ROUSSEAU, I., BARD, C., and BOJANOWSKI, M. (2000, September) Patterns of music agnosia associated with middle cerebral artery infarcts. **Brain,** vol. 123 (pt. 9), pp. 1926-1938.

AYOTTE, J., PERETZ, I., HYDE, K. (2002) Congenital amusia-a group study of adults afflicted with a music-specific disorder. **Brain,** vol. 125, pp. 238-251.

BADDELEY, A. (1984) Neuropsychological evidence and the semantic/episodic distinction. **The Behavioral and Brain Sciences,** vol. 7 (pt. 2), pp. 238-239.

BADDELEY, A. (1992) Working Memory. **Science,** January; vol. 255, pp. 255-59.

BADDELEY, A. (1993) Working Memory and Conscious Awareness. In: COLLINS, A. F., GATHERCOLE, S. E., CONWAY, M. A. and MORRIS, P. E. ed. **Theories of Memory**, Hove, Lawrence Erblaum Associates Ltd. pp. 11-28.

BADDELEY, A. (1996) Your Memory, London, Prion Publishing

BADDELEY, A., GATHERCOLE, S. and PAPAGNO, C. (1998, January) The phonological loop as a language learning device. **Psychological Review,** vol. 105 (pt. 1), pp. 158-173.

BAECK, E. (1996) Was Maurice Ravel's illness a corticobasal degeneration? **Clinical Neurology and Neurosurgery,** February; vol. 98 (pt. 1), pp. 57-61.

BAECK, E. (2002, September) The neural networks of music. **European Journal of**

Neurology, vol.9 (pt. 5), pp. 449-456.

BARNEA, A., GRANOT, R., and PRATT, H. (1994, February) Absolute pitch-electrophysiological evidence. **International Journal of Psychophysiology,** vol. 16 (pt. 1), pp. 29-38.

BASSO, A. and CAPITANI, E. (1985, May) Spared musical abilities in a conductor with global aphasia and ideomotor apraxia. **Journal of Neurology, Neurosurgery, and Psychiatry,** vol. 48 (pt. 5), pp. 407-412.

BASSO, A. (1993) Amusia. In: BOLLER, F., AND GRAFMAN, J. ed. **Handbook of Neuropsychology,** vol. 8, pp. 391-409.

BEATON, A. A. (1997, November) The relation of planum temporale asymmetry and morphology of the corpus callosum to handedness, gender, and dyslexia: a review of the evidence. **Brain and Language,** vol. 60 (pt. 2), pp. 255-322.

BELIN, P., ZATORRE, R.,J., LAFAILLE, P., AHAD, P., AND PIKE, B. (2000, January 20) Voice-selective areas in human auditory cortex. **Nature,** vol. 403 (pt. 6767), pp. 309-312.

BENTON, A. L. (1977) The Amusias. In: CRITCHLEY, M. and HENSON, R. A. ed. **Music and the Brain**, London, William Heinemann Medical Books, Ltd. pp. 378-397.

BERENDT, J. (1985) **The Third Ear,** New York, Henry Holt and Company, Inc.

BERMAN, I. W. (1981, January) Musical functioning, speech lateralization and the amusias. **South African Medical Journal,** vol. 59 (pt. 3), pp. 78-81.

BERNSTEIN, L. (1976) **The Unanswered Question-Six Talks at Harvard,** Cambridge, Harvard University Press.

BHATTACHARYA, J. and PETSCHE, H. (2001, February 12) Musicians and the gamma band: a secret affair? **Neuroreport**, vol. 12 (pt. 2), pp. 371-374.

BINDER, J. R., FROST, J. A., HAMMEKE, T. A., RAO, S. M. and COX, R. W. (1996, August) Function of the left planum temporale in auditory and linguistic processing. **Brain,** vol. 199 (pt. 4), pp. 1239-1247.

BOOTHROYD, A. (1997) Auditory development of the hearing child. **Scandinavian Audiology. Supplementum,** vol. 46, pp. 9-16.

BOUCHER, R. and BRYDEN, M. (1997) Laterality effects in the processing of melody and timbre. **Neuropsychologia,** November; vol. 35 (pt. 11), pp. 1167-1473.

BROCKWAY, J.P., FOLLMER, R.L., PREUS, L.A., PRIOLEAU, C.E., BURROWS, G.S., SOLSRUD, K.A., COOKE, C.N., GREENHOOT, J.H., and HOWARD, J. (1998, January) Memory, simple and complex language, and the temporal lobe. **Brain and**

Language, vol. 61 (pt. 1), pp. 1-29.

BROWNING, C.A. (2000, December) Research brief: using music during childbirth. **Birth,** vol. 27 (pt. 4), pp. 272-276.

BRYDEN, M.P., LEY, R.G., and SUGARMAN, J.H. (1982) A left-ear advantage for identifying the emotional quality of tonal sequences. **Neuropsychologia,** vol. 20 (pt. 1), pp. 83-87.

BUCKNER, R. L., PETERSEN, S. E., OJEMANN, J. G., MIEZIN, F. M., SQUIRE, L. R. and RAICHLE, M. E. (1995, January) Functional anatomical studies of explicit and implicit memory retrieval tasks. **Journal of Neuroscience,** vol. 15 (pt. 1), pp. 12-29.

BUCKNER, R. L., RAICHLE, M. E., MIEZIN, F. M. and PETERSEN, S. E. (1996, October 1) Functional anatomic studies of memory retrieval for auditory words and visual pictures. **Journal of Neuroscience,** vol. 16 (pt. 19), pp. 6219-6235.

BUCKNER, R. L., KOUTSTAAL, W., SCHACTER, D. L., DALE, A. M., ROTTE, M. and ROSEN, B. R. (1998, April) Functional-anatomic study of episodic retrieval. II. Selective averaging of event-related fMRI trials to test the retrieval success hypothesis. **Neuroimage,** vol. 7 (pt. 3), pp. 163-175.

CADALBET, A., LANDIS, T., REGARD, M., and GRAVES, R.E. (1994, October) Singing with and without words: hemispheric asymmetries in motor control. **Journal of Clinical and Experimental Neuropsychology,** vol. 16 (pt. 5), pp. 664-670.

CADIGAN, M.E., CARUSO, N.A., HALDEMAN, S.M., MCNAMARA, M.E., NOYES, D.A., SPADAFORA, M.A., and CARROLL, D.L. (2001, Winter) The effects of music on cardiac patients on bed rest. **Progress in Cardiovascular Nursing,** vol. 16 (pt. 1), pp. 5-13.

CAHILL, L., and MCGAUGH, J.L. (1998, July) Mechanisms of emotional arousal and lasting declarative memory. **Trends in Neuroscience,** vol 21 (pt. 7), pp. 294-299.

CALLICOTT, J. H., MATTAY, V. S., BERTOLINO, A., FINN, K., COPPOLA, R., FRANK, J. A., GOLDBERG, T. E. and WEINBERGER, D. R. (1999, January-February) Physiological characteristics of capacity constraints in working memory as revealed by functional MRI. **Cerebral Cortex,** vol. 9 (pt. 1),
pp. 20-26.

CAMPBELL, D. G. (1997) **The Mozart Effect,** New York, Avon Books.

CHERINGTON, M., SMITH, R., NIELSEN, P.J. (1999) The life, legacy, and premature death of Felix Mendelssohn. **Seminars in Neurology (Supplement),** vol. 19 (pt.1), pp.47-52

CHRISTMAN, S. (1993) Handedness in musicians: bimanual constraints on performance. **Brain and Cognition,** vol. 22, pp. 266-272.

CHUTKOW, P. (1994) **Depardieu: A Biography,** Canada, Knopf.

CLARKE, E. F. (1989) Issues in language and music. **Contemporary Music Review,** vol. 4 pp. 9-22.

COGNITIVE BRAIN RESEARCH UNIT (1999) Mismatch Negativity Image. http://www.cbru.helsinki.fi/mmn.html (23 August, 2000)

COLLETTE, F., SALMON, E., LINDEN, M. V. D., CHICHERIO, C., BELLEVILLE, S., DEGUELDRE, C., DELFIORE, G. and FRANCK, G. (1999, January) Regional brain activity during tasks devoted to the central executive of working memory. **Brain Research. Cognitive Brain Research,** vol. 7 (pt. 3), pp. 411-417.

CONFAVREUX, C., CROISILE, B., GARASSUS, P., AIMARD, G. and TRILLET, M. (1992) Progressive amusia and aprosody. **Archives of Neurology,** September; vol. 49 (pt. 9), pp. 971-976.

CONWAY, M. A. and RUBIN, D. C. (1993) The structure of autobiographical memory. In: COLLINS, A. F., GATHERCOLE, S. E., CONWAY, M. A. and MORRIS, P. E. ed. **Theories of Memory**, Hove, Erlbaum Associates Ltd. pp. 103-138.

COURTNEY, S. M., PETIT, L., HAXBY, J. V. and UNGERLEIDER, L. G. (1998, November 29) The role of prefrontal cortex in working memory: examining the contents of consciousness. **Philosophical Transactions of the Royal Society of London.Series B:Biological Sciences,** vol. 353 (pt. 1377), pp. 1819-1828.

COWAN, N., SUOMI, K. and MORSE, P. A. (1982, August) Echoic storage in infant perception. **Child Development,** vol. 53 (pt. 4), pp. 984-990.

CROWDER, R.G. (1971) Waiting for the stimulus suffix: decay, delay, rhythm, and readout in immediate memory. **Quarterly Journal of Experimental Psychology,** vol. 23, pp. 324-3440.

CROWDER, R. G. (1993) Systems and principles in memory theory: Another critique of pure memory. In: COLLINS, A. F., GATHERCOLE, S. E., CONWAY, M. A. and MORRIS, P. E. ed. **Theories of Memory**, Hove, Lawrence Erlbaum Associates Ltd. pp. 139-162.

CYTOWIC, R. E. (1976, July) Aphasia in Maurice Ravel. **Bulletin of the Los Angeles Neurological Association**, vol. 41 (pt. 3), pp. 109-114.

DAMASIO, A. and DAMASIO, H. (1977) Musical faculty and cerebral dominance. In: CRITCHLEY, M. and HENSON, R. ed. **Theories of Memory**, Hove, Lawrence Erlbaum Associates Ltd. pp. 141-155.

DAVIS, D.S. (2000) **The Tomatis Method,** http://www.thedaviscenter.com/therapies/t-

tomatis.htm, 3 October 2003.

DAVIS, P. J. (1999 March) Gender differences in autobiographical memory for childhood emotional experiences. **Journal of Personality and Social Psychology**, vol. 76 (pt. 3), pp. 498-510.

DECASPER, A. J. and FIFER, W. P. (1980) Of human bonding: newborns prefer their mother's voice. **Science**, vol. 208 pp. 1174-1176.

DEFFAA, C. (1997) All Sides Now (Sound Recording Review). **Entertainment Weekly,** vol. 399 pp. 77.

DE GUISE, E., DEL PESCE, M., FOSCHI, N., QUATTRINI, A., PAPO, I., LASSONDE, M. (1999, June) Callosal and cortical contribution to procedural learning. **Brain,** vol. 122 (pt. 6), pp. 1049-1062.

DEJEAN, V. (1998) **Tomatis Auditory Training,** http://www.his.com/~spectrum/abouttomatis.html, 3 October 2003.

DESIMONE, R. (1992) The physiology of memory: recordings of things past. **Science,** October 9; vol. 258 pp. 245-246.

DEUTSCH, D. (1977) Memory and attention in music. In: CRITCHLEY, M. and HENSON, R. A. ed. **Music and the Brain**, London, William Heinemann Medical Books, Ltd. pp. 95-130.

DEUTSCH, D. (1978, February 3) Pitch memory: an advantage for the left-handed. **Science,** vol. 199 (pt. 4328), pp. 559-560.

DEUTSCH, D. (1983) The octave illusion in relation to handedness and familial handedness background. **Neuropsychologia,** vol. 21 (pt. 3), pp. 289-293.

DEUTSCH, D. (1988, January) Lateralization and sequential relationships in the octave illusion. **Journal of the Acoustical Society of America,** vol. 83 (pt. 1), pp. 365-369.

DONALDSON, D. I. and RUGG, M. D. (1999 May 3) Event-related potential studies of associative recognition and recall: electrophysiological evidence for context dependent retrieval processes. **Brain Research. Cognitive Brain Research**, vol. 8 (pt. 1), pp. 1-16.

DOUEN, A. G. and BOURQUE, P. R. (1997, February) Musical auditory hallucinosis from Listeria rhombencephalitis. **Canadian Journal of Neurological Sciences,** vol. 24 (pt. 1), pp. 70-72.

DOWLING, J. E. (1998) **Creating Mind,** New York, W.W. Norton & Company.

DOWLING, W.J., & FUJITANI, D.S. (1971) Contour, interval, and pitch recognition in memory for short melodies. **Journal of the Acoustical Society of America,** vol.49, pp. 524-531.

DOWLING, W. J. (1977) The perception of melodies distorted by splitting into several octaves: effects of increasing proximity and melodic contour. **Perception and Psychophysics,** vol. 21 (pt. 1), pp. 60-64.

DOWLING, W. J. (1982) Melodic information processing and its development. In: DEUTSCH, D. ed. **The Psychology of Music**, New York, Academic Press, pp. 413-429.

DOWLING, W. J. (1991) Tonal strength and melody recognition after long and short delays. **Perception and Psychophysics,** vol. 50 (pt. 4), pp. 305-313.

EDWARDS, B. (1979) **Drawing on the Right Side of the Brain,** Los Angeles, J.P. Tarcher, Inc.

ELDRIDGE, L.L., KNOWLTON, B.J., FURMANSKI, C.S., BOOKHEIMER, S.Y., and ENGEL, S.A. (2000, November) Remembering episodes: a selective role for the hippocampus during retrieval. **Nature Neuroscience,** vol. 3 (pt. 11), pp. 1149-1152.

EVERS, S., DANNERT, J., RODDING, D., ROTTER, G. and RINGELSTEIN, E. B. (1999, January) The cerebral haemodynamics of music perception: a transcranial Doppler sonography study. **Brain**, vol. 122 (pt. 1), pp. 75-85.

FILLEY C.M., M. D. (1995) **Neurobehavioral Anatomy**, Niwot, University Press of Colorado

FISK, J. E. and WARR, P. (1996, June) Age and working memory: the role of perceptual speed, the central executive, and the phonological loop. **Psychology and Aging,** vol. 11 (pt. 2), pp. 316-323.

FLETCHER, P., BUCHEL, C., JOSEPHS, O., FRISTON, K. and DOLAN, R. (1999 March) Learning-related neuronal responses in prefrontal cortex studied with functional neuroimaging. **Cerebral Cortex**, vol. 9 (pt. 2), pp. 168-178.

FOSTER, L.M., HYND, G.W., MORGAN., and HUGDAHL, K. (2002, January) Planum temporale asymmetry and ear advantage in dichotic listening in developmental dyslexia and attention-deficit/hyperactivity disorder (ADHD). **Journal of the International Neuropsychological Society,** vol. 8 (pt. 1), pp. 22-36.

FOUNDAS, A. L., LEONARD, C. M., GILMORE, R., FENNELL, E. and HEILMAN, K. M. (1994, October) Planum temporale asymmetry and language dominance. **Neuropsychologia,** vol. 32 (pt. 10), pp. 1225-1231.

FRANKL, V. (1997) **Man's Search For Meaning,** Washington Square Press

FREEMAN, M. (1995, May) The 12-point star: a conversation with Pat Martino. **Guitar Player,** vol 29 (pt. 5), pp. 136(1).

FRIES, W., and SWIHART, A.A. (1990) Disturbance of rhythm sense following right hemisphere damage. **Neuropsychologia,** vol. 28 (pt. 12), pp. 1317-1323.

FURNEAUX, S. and LAND, M.F. (1999, December 7) The effects of skill on the eye-hand span during musical sight-reading. **Proceedings of the Royal Society of London, Series B: Biological Sciences,** vol. 266 (pt. 1436), pp. 2435-2440.

FUSTER, J. M. (1999) Synopsis of function and dysfunction of the frontal lobe. **Acta Psychiatrica Scandinavica.Supplementum,** vol. 395, pp. 51-57.

GAGNON, L., and PERETZ, I. (2000, June-August) Laterality effects in processing tonal and atonal melodies with affective and nonaffective task instructions. **Brain and Cognition,** vol 43 (pt. 1-3), pp. 206-210.

GARDINER, J. M. (1983, August) On recency and echoic memory.**Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences,** vol. 302 (pt. 1110), pp. 267-282.

GARDINER, J. M. and JAVA, R. I. (1993) Recognizing and remembering. In: COLLINS, A. F., GATHERCOLE, S. E., CONWAY, M. A. and MORRIS, P. E. ed. **Theories of Memory,** Hove, Lawrence Erlbaum Associates Ltd. pp. 163-188.

GARDNER, H. (1976) **The Shattered Mind-The Person After Brain Damage,** New York, Vintage Books.

GARFINKEL, H. (1972) Studies of the routine grounds of everyday activities. In: SUDNOW, D. ed. **Studies in Social Interaction,** New York, The Free Press.

GAUGER, L. M., LOMBARDINO, L. J. and LEONARD, C. M. (1997, December) Brain morphology in children with specific language impairment. **Journal of Speech, Language, and Hearing Research,** vol. 40 (pt. 6), pp. 1272-1284.

GEGENFURTNER, K. R. and SPERLING, G. (1993 August) Information transfer in iconic memory experiments. **Journal of Experimental Psychology: Human Perception and Performance,** vol. 19 (pt. 4), pp. 845-866.

GENE-COS, N., RING, H. A., POTTINGER, R. C. and BARRETT, G. (1999, January) Possible roles for mismatch negativity in neuropsychiatry. **Neuropsychiatry, Neuropsychology, and Behavioral Neurology,** vol. 12 (pt. 1), pp. 17-27.

GILMOR, T.M. (1989) The efficacy of the Tomatis Method for children with learning and communication disorders: A meta-analysis. In: **About the Tomatis Method,** The Listening Centre Press.

GLASSMAN, R. B., LENIEK, K. M. and HAEGERICH, T. M. (1998, October) Human working memory capacity is 7+/-2 in a radial maze with distracting interruption: possible implication for neural mechanisms of declarative and implicit long-term memory. **Brain Research Bulletin,** vol. 47 (pt. 3), pp. 249-256.

GLASSMAN, R.B. (1999, September 15) Hypothesized neural dynamics of working memory: several chunks might be marked simultaneously by harmonic frequencies within an octave band of brain waves. **Brain Research Bulletin,** vol. 50 (pt. 2), pp. 77-93.

GOMES, H., BERNSTEIN, R., RITTER, W., VAUGHAN, H. G. and MILLER, J. (1997, November) Storage of feature conjunctions in transient auditory memory. **Psychophysiology,** vol. 34 (pt. 6), pp. 712-716.

GOMES, H., SUSSMAN, E., RITTER, W., KURTZBERG, D., COWAN, N. and VAUGHAN, H. (1999, January) Electrophysiological evidence of developmental changes in the duration of auditory sensory memory. **Developmental Psychology,** vol. 35 (pt. 1), pp. 294-302.

GOMEZ BELDARRAIN, M., GRAFMAN, J., PASCUAL-LEONE, A., GARCIA-MONCO, J.C. (1999, June 10) Procedural learning is impaired in patients with prefrontal lesions. **Neurology,** vol. 52 (pt. 9), pp. 1853-1860.

GORDON, A. G. (1997, August) Do musical hallucinations always arise from the inner ear? **Medical Hypotheses,** vol. 29 (pt. 2), pp. 111-122.

GORDON, A.G. (1999) Cochlear sound-movement and musical misperception. **Brain and Cognition,** vol. 40 (pt.1) p.179.

GORDON, E.E. (1982) **Intermediate Measures of Music Audiation.** Chicago, G.I.A. Publications

GORDON, H. W. (1970) Hemispheric asymmetries in the perception of musical chords. **Cortex,** vol. 6 pp. 387-398.

GORDON, H. W. and BOGEN, J. E. (1974) Hemispheric lateralization of singing after intracarotid sodium amylobarbitone. **Journal of Neurology, Neurosurgery, and Psychiatry,** vol. 37 pp. 727-38.

GRIFFITHS, T., REES, A., WITTON, C., CROSS, P. and GREEN, G. (1997) Spatial and temporal auditory processing deficits following right hemisphere infraction- a psychophysical study. **Brain,** vol. 120 pp. 785-794.

HALL, A. (1999) Speaking in tones. **Scientific American,** http://wwww.sciam.com/exhibit/1999/110199pitch/index.html

HALPERN, A.R., ZATORRE, R.J. (1999, October-November) When that tune runs through your head: a PET investigation of auditory imagery for familiar melodies. **Cerebral Cortex,** vol.9 (pt.7), pp. 697-704.

HALPERN, A.R., and O'CONNOR, M.G. (2000 July) Implicit memory for music in Alzheimer's disease. **Neuropsychology,** vol. 14 (pt. 3), 391-317.

HANNAFORD, C. (1997) **The Dominance Factor**, Arlington, Great Ocean Publishers.

HENSON, R. A. (1988 June 4) Maurice Ravel's illness: a tragedy of lost creativity. **British Medical Journal (Clinical Research Ed.)**, vol. 296 (pt. 6636), pp. 1585-1588.

HENKE, K., KROLL, N.E.A., BEHNIEA, H., AMARAL, D.G., MILLER, M.B., RAFAL, R., and GAZZANIGA, M.S. (1999) Memory lost and regained following bilateral hippocampal damage. **Journal of Cognitive Neuroscience,** vol. 11, pp. 682-697.

HERING, R., CATARCI, T. and STEINER, T. (1995) Handedness in musicians. **Functional Neurology,** vol. 10 (pt. 1), pp. 23-26.

HINGTGEN, C.M. (1999) The tragedy of Sergei Prokofiev. **Seminars in Neurology,** vol. 19, (Supplement 1), pp. 59-61.

HOCK, B.J., and BUNSEY, M.D. (1998, September) Differential effects of dorsal and ventral hippocampal lesions. **Journal of Neuroscience,** vol. 18 (pt 17), pp. 7027-7032.

HOOD, J. D. (1977) Psychological and physiological aspects of hearing. In: CRITCHLEY, M. and HENSON, R. A. ed. **Music and the Brain**, Hove, William Heinemann Medical Books Ltd. pp. 32-47.

HOPKINS, W. D., MARINO, L., RILLING, J. K. and MACGREGOR, L. A. (1998, August 24) Planum temporale asymmetries in great apes as revealed by magnetic resonance imaging (MRI). **Neuroreport,** vol. 9 (pt. 12), pp. 2913-2918.

HORIKOSHI, T., ASARI, Y., WATANABE, A., NAGASEKI, Y. and KOMIYA, K. (1997, March) Music alexia in a patient with mild pure alexia: disturbed visual perception of nonverbal meaningful figures. **Cortex,** vol. 33 (pt. 1), pp. 187-194.

HOUGH, M. S., DANIEL, H. J., SNOW, M. A., O'BRIEN, K. F. and HUME, W. G. (1994) Gender differences in laterality patterns for speaking and singing. **Neuropsychologia,** September; vol. 32 (pt. 9), pp. 1067-1078.

HUANG, S. T. and GLENBERG, A. M. (1986, Winter) Echoic and retrieval accounts of the long-term modality effect tested using the suffix procedure. **American Journal of Psychology,** vol. 99 (pt. 4), pp. 453-470.

HUBBARD, T. L. and STOECKIG, K. (1988, October) Musical imagery: generation of tones and chords. **Journal of Experimental Psychology: Learning, Memory, and Cognition,** vol. 14 (pt. 4), pp. 656-667.

HUBBARD, T. L. (1998 December) Listeners can discriminate among major chord positions. **Perceptual and Motor Skills,** vol. 87 (3 pt.1), pp. 891-917.

HUDSPETH, A.J., and KONISHI, M. (2000, October 24) Auditory neuroscience: development, transduction, and integration. **Proceedings of the National Academy of Sciences of the United States of America,** vol. 97 (pt. 22), pp. 11690-11691.

HUGDAHL, K., CARLSSON, G., UVEBRANT, P. and LUNDERVOLD, A. J. (1997, December) Dichotic-listening performance and intracarotid injections of amobarbital in children and adolescents: preoperative and postoperative comparisons. **Archives of Neurology,** vol. 54 pp. 1494-1500.

HUGDAHL, K., HEIERVANG, E., NORDBY, H., SMIEVOLL, A. L., STEINMETZ, H., STEVENSON, J. and LUND, A. (1998) Central Auditory processing, MRI morphometry and brain laterality: applications to dyslexia. **Scandinavian Audiology. Supplementum,** vol. 49, pp. 26-34.

HUGHES, J. R., DAABOUL, Y., FINO, J. J. and SHAW, G. L. (1998) The "Mozart effect" on epileptiform activity. **Clinical Electroencephalography,** July; vol. 29 (pt. 3), pp. 109-119.

HUGHES, J.R., FINO, J.J. (2000, April) The Mozart effect: distinctive aspects of the music-a clue to brain coding? **Clinical Electroencephalography,** vol. 31 (pt. 2), pp. 94-103.

HYMAN, I. E. and LOFTUS, E. F. (1998 December) Errors in autobiographical memory. **Clinical Psychology Review**, vol. 18 (pt. 8), pp. 933-947.

JANCKE, L. and STEINMETZ, H. (1993, November) Auditory lateralization and planum temporale asymmetry. **Neuroreport,** vol. 5 (pt. 2), pp. 169-172.

JANCKE, L., SCHLAUG, G. and STEINMETZ, H. (1997) Hand skill asymmetry in professional musicians. **Brain and Cognition,** vol. 34 pp. 424-432.

JANCKE, L, SHAH, N.J., PETERS, M. (2000, September 1) Cortical activations in primary and secondary motor areas for complex bimanual movements in professional pianists. **Brain Research: Cognitive Brain Research,** vol 10 (pt. 1-2), pp. 177-183.

JAVA, R. I., KAMINSKA, Z. and GARDINER, J. M. (1995) Recognition memory and awareness for famous and obscure musical themes. **European Journal of Cognitive Psychology,** vol. 7 (pt. 1), pp. 41-53.

JOHNSON, K.A., and BECKER, J.A. (1999) Whole Brain Atlas. http://www.med.harvard.edu/AALIB/cases/caseM/mr1_t/021.html (23 August, 2000).

JOHNSON, R.C., BOWERS, J.K., GAMBLE, M. LYONS, F.M. PRESBREY, T.W. and VETTER, R.R. (1977, September) Ability to transcribe music and ear superiority for tone sequences. **Cortex,** vol. 13 (pt. 3), pp. 295-299.

JOHNSON, R.C., GREEN, P., AHERN, F.M., and COLE, R.E. (1983-1984) Cognitive correlates of hemispheric performance on dichotic tasks. **International Journal of Aging and Human Development,** vol. 18 (pt. 3), pp. 185-195.

JOHNSON, M. K., SUENGAS, A. G., FOLEY, M. A. and RAYE, C. L. (1988) Phenomenal characteristics of memories for perceived and imagined autobiographical events. **Journal of Experimental Psychology:General,** vol. 117 (pt. 4), pp. 371-376.

JOHNSON, P. R. (1977, December) Dichotically-stimulated ear differences in musicians and nonmusicians. **Cortex**, vol. 13 (pt. 4), pp. 385-389.

KAERNBACH, C., SCHROGER, E. and GUNTER, T. C. (1998, February 6) Human event-related brain potentials to auditory periodic noise stimuli. **Neuroscience Letters,** vol. 242 (pt. 1), pp. 17-20.

KALLMAN, H. J., CAMERON, P. A., BECKSTEAD, J. W. and JOYCE, E. (1987) Ear of input as a determinant of pitch-memory interference. **Memory and Cognition,** vol. 15 (pt. 5), pp. 454-460.

KANEY, S., BOWEN-JONES, K. and BENTAll, R. P. (1999 March) Persecutory delusions and autobiographical memory. **British Journal of Clinical Psychology**, vol. 28 (pt. 1), pp. 97-102.

KAWAMURA, M., MIDORIKAWA, A., and KEZUKA, M. (2000, September 28) Cerebral localization of the center for reading and writing music. **Neuroreport,** vol. 11 (pt. 14), pp. 3299-3303.

KERNER, D. (1975 (April 4)) The death of Ravel. **MMW. Munchener Medizinische Wochenschrift**, vol. 117 (pt. 14), pp. 591-596.

KESTER, D.B., SAYKIN, A.J., SPERLING, M.R., O'CONNOR, M.J., ROBINSON, L.J., and GUR, R.C. (1991) Acute effect of anterior temporal lobectomy on musical processing. **Neuropsychologia,** vol. 29 (pt. 7), pp. 703-708.

KIMURA, D. (1964) Left-right differences in the perception of melodies. **Quarterly Journal of Experimental Psychology,** vol. 15 pp. 156-165.

KIMURA, D. (1967) Functional asymmetry of the brain in dichotic listening. **Cortex,** vol. 3 pp. 163-178.

KINSLER, V. and CARPENTER, R. H. (1995 May) Saccadic eye movements while reading music. **Vision Research**, vol. 35 (pt. 10), pp. 1447-1458.

KOELSCH, S., SCHROGER, E., TERVANIEMI, M. (1999, April 26) Superior pre-attentive auditory processing in musicians. **Neuroreport,** vol. 10 (pt. 6), pp. 1309-1313.

KOELSCH, S., GUNTER, T., FRIEDERICI, A.D., and SCHROGER, E. (2000, May) Brain indices of music processing: "nonmusicians" are musical. **Journal of Cognitive Neuroscience,** vol. 12 (pt. 3), pp. 520-541.

LARMANDE, P., BLANCHARD, F., SINTES, J., BELIN, C. and AUTRET, A. (1984) Melodic dichotic listening test. Influence of the status of hemispheric activation in normal

subjects, musicians and non-musicians. **Revue Neurologique,** vol. 140 (pt. 1), pp. 49-54.

LEASK, S. J. and CROW, T. J. (1997, October) How far does the brain lateralize? :an unbiased method for determining the optimum degree of hemispheric specialization. **Neuropsychologia,** vol. 35 (pt. 10), pp. 1381-1387.

LECHEVALIER, B., ROSSA, Y., EUSTACHE, F., SCHUPP, C., BONER., L. and BAZIN, C. (1984) Case of cortical deafness sparing the music area. **Revue Neurologique (Paris),** vol. 140 (pt. 3), pp. 190-201.

LECHEVALIER, B., PLATEL, H. and EUSTACHE, F. (1995, Aug-Sep) Neuropsychology of musical identification. **Revue Neurologique (Paris),** vol. 151 (pt. 8-9), pp. 505-510.

LECHEVALIER, B. (1997, June-July) Perception of musical sounds: contributions of positron emission tomography. **Bulletin De L Academie Nationale De Medecine,** vol. 181 (pt. 6), pp. 1199-1200.

LEE, L.T. (1999, September) A study of the noise hazard to employees in local discotheques. **Singapore Medical Journal.** Vol. 40 (pt. 9), 571-574.

LIASIS, A. and TOWELL, A. (1999, March) Intracranial auditory detection and discrimination potentials as substrates of echoic memory in children. **Brain Research: Cognitive Brain Research,** vol. 7 (pt. 4), pp. 503-506.

LIEGEOIS-CHAUVEL, C., MUSOLINO, A., BADIER, J. M., MARQUIS, P. and CHAUVEL, P. (1994, May) Evoked potentials recorded from the auditory cortex in man: evaluation and topography of the middle latency components. **Electroencephalography and Clinical Neurophysiology,** vol. 92 (pt. 3), pp. 204-214.

LEIGEOIS-CHAUVEL, C., LAGUITTON, V., BADIER, J. M., SCHWARTZ, D. and CHAUVEL, P. (1995, August/September) Cortical mechanisms of auditive perception in man: contribution of cerebral potentials and evoked magnetic fields by auditive stimulations. **Revue Neurologique,** vol. 151 (pt. 8-9), pp. 495-504.

LIEGEOIS-CHAUVEL, C., PERETZ, I., BABAI, M., LAGUITTON, V. and CHAUVEL, P. (1998, October) Contribution of different cortical areas in the temporal lobes to music processing. **Brain,** vol. 121 (pt. 10), pp. 1853-1867.

LONDON, M. (1982, May) Music and Language: An ethnographic study of music learning and interpreting situations. **Doctoral Dissertation.**

LONG, P. (1977) Relationships between pitch memory in short melodies and selected factors. **Journal of Research in Music Education,** vol. 25 pp. 272-282.

LONG, J.M., and KESNER, R.P. (1998, June) Effects of hippocampal and parietal cortex lesions on memory for egocentric distance and spatial location information in rats. **Behavioral Neuroscience,** vol. 112 (pt. 3), pp. 480-495.

LOPEZ-ANTUNEZ, L. (1971) **Atlas of Human Anatomy,** Philadelphia, W.B. Saunders.

LOPEZ-GARCIA, J.C. (1998) Two different forms of long-term potentiation in the hippocampus. **Neurobiology,** vol. 6 (pt 1), pp. 75-98.

LORING, D. W., MEADOR, K. J., LEE, G. P., MURRO, A. M., SMITH, J. R., FLANIGIN, H. F., GALLAGHER, B. B. and KING, D. W. (1990) Cerebral language lateralization: evidence from intracarotid amobarbital testing. **Neuropsychologia,** vol. 28 (pt. 8), pp. 831-838.

LORING, D. W., LEE, G. P., MEADOR, K. J., FLANIGIN, H. F., SMITH, J. R., FIGUEROA, R. E. and MARTIN, R. C. (1990, April) The intracarotid amobarbital procedure as a predictor of memory failure following unilateral temporal lobectomy. **Neurology,** vol. 40 (pt. 4), pp. 605-610.

LORING, D. W., MEADOR, K. J., LEE, G. P., FLANIGIN, H. F., KING, D. W. and SMITH, J. R. (1990, March) Crossed aphasia in a patient with complex partial seizures: evidence from intracarotid amobarbital testing, functional cortical mapping, and neuropsychological assessment. **Journal of Clinical Experimental Neuropsychology,** vol. 12 (pt. 2), pp. 340-354.

LURIA, A. R., TSVETKOVA, L. S. and FUTER, D. S. (1965) Aphasia in a composer. **The Journal of Neurological Sciences,** vol. 2 pp. 288-292.

LURIA, A. R. (1976) **The Neuropsychology of Memory,** Washington D.C., V.H. Winston & Sons.

MACNIE, J. (1997, March) Agony and the Ecstasy-Pat Martino and Les Paul. **Down Beat,** vol. pp. 16-21.

MADAULE, P. (1994) **When Listening Comes Alive-A Guide to Effective Learning and Communication,** Ontario, Moulin Publishing.

MAGUIRE, E. A. and MUMMERY, C. J. (1999) Differential modulation of a common memory retrieval network revealed by positron emission tomography. **Hippocampus,** vol. 9 (pt. 1), pp. 54-61.

MARTINKAUPPI, S., RAMA, P. ARONEN, H.J., KORVENOJA, A., and CARLSON, S. (2000, September) Working memory of auditory localization. **Cerebral Cortex,** vol. 10 (pt. 9), pp. 889-898.

MARTIN-LOECHES, M., SCHWEINBERGER, S. R. and SOMMER, W. (1997) The phonological loop model of working memory: An ERP study of irrelevant speech and phonological similarity effects. **Memory & Cognition,** vol. 25 (pt. 4), pp. 471-483.

MARYMOUNT COLLEGE (2000) Broca's Area.
http://www.marymt.edu/~psychol/broca.jpg (23 August, 2000)

MARYMOUNT COLLEGE (2000) Human Brain/Frontal Lobe. http://www.marymt.edu/~psychol/frontal.html (23 August, 2000)

MAVLOV, L. (1980) Amusia due to rhythm agnosia in a musician with left hemisphere damage: a non-auditory supramodal effect. **Cortex,** vol. 16 pp. 331-338.

MCCUTCHEON, L.E. (2000, August) Another failure to generalize the Mozart Effect. **Psychology Report,** vol. 87 (pt. 1), 325-330.

MCFARLAND, H. and FORTIN, D. (1982, November) Amusia due to right temporoparietal infarct. **Archives of Neurology,** vol. 39 (pt. 11), pp. 725-727.

MCFARLAND, R.A., and KENNISON, R. (1989, April) Handedness affects emotional valence asymmetry. **Perception and Motor Skills,** vol. 68, (pt. 2), 435-441.

MCINTOSH, A. R. (1998, November 30) Understanding neural interactions in learning and memory using functional neuroimaging. **Annals of the New York Academy of Sciences,** vol. 855 pp. 556-571.

MCKINNON, M.C. and SCHELLENBERG, E.G. (1997, June) A left-ear advantage for forced-choice judgements of melodic contour. **Canadian Journal of Experimental Psychology,** vol. 51 (pt. 2), pp. 171-175.

METTERNICH, F.U. and BRUSIS, T. (1999, November) Acute hearing loss and tinnitus caused by amplified recreational music. **Laryngo-Rhino-Otologie,** vol. 78 (pt.11) pp. 614-619.

MIDORIKAWA, A., and KAWAMURA, M. (2000, September 11) A case of musical agraphia. **Neuroreport,** vol. 11 (pt. 13), pp. 3053-3057.

MILLER, G.A. (1956). The magical number seven, plus or minus two; Some limits of our capacity for processing information. **Psychological Review,** vol. 63 pp. 81-97

MINSON, R.B. (2003) The Center for Inner Change, http://www.centerforinnerchange.com/, 3 October 2003.

MIYAZAKI, K. (1995, October) Perception of relative pitch with different references: some absolute-pitch listeners can't tell musical interval names. **Perception and Psychophysics,** vol. 57 (pt. 7), pp. 962-970.

MOFFATT, S. D., HAMPSON, E. and LEE, D. H. (1998) Morphology of the planum temporale and corpus callosum in left handers with evidence of left and right hemisphere speech representation. **Brain**, vol. 121 (pt. 12), pp. 2369-2379.

MORGAN, A. E. and HYND, G. W. (1998, June) Dyslexia, neurolinguistic ability, and anatomical variation of the planum temporale. **Neuropsychology Review,** vol. 8 (pt. 2), pp. 79-93.

MOSCOVITCH, M. (1982) A neuropsychological approach to perception and memory in normal and pathological aging. In: CRAIK, F. and TREHUB, S. ed. **Advances in the Study of Communication and Affect-Aging and Cognitive Processes**, New York, Plenum Press. pp. 55-79.

MUNTE, T. F., SCHUPPERT, M., JOHANNES, S., WIERINGA, B. M., KUHLMETZ, C. and ALTENMULLER, E. (1998 November 6) Brain potentials in patients with music perception deficits: evidence for an early locus. **Neuroscience Letters,** vol. 256 (pt. 2), pp. 85-88.

NAATANEN, R., PAAVILAINEN, P. and REINIKAINEN, K. (1989, December 15) Do event-related potentials to infrequent decrements in duration of auditory stimuli demonstrate a memory trace in man? **Neuroscience Letters,** vol. 107 (pt. 1-3), pp. 347-352.

NAKAMURA, S., SADATO, N., OOHASHI, T., NISHINA, E., FUWAMOTO, Y., and YONEKURA, Y. (1999, November 19) Analysis of music-brain interaction with simultaneous measurement of regional cerebral blood flow and electroencephalogram beta rhythm in human subjects. **Neuroscience Letters,** vol. 275 (pt. 3) pp. 222-226.

NATION, K., ADAMS, J. W., BOWYER-CRANE, C. A. and SNOWLING, M. J. (1999, June) Working memory deficits in poor comprehenders reflect underlying language impairments. **Journal of Experimental Child Psychology,** vol. 73 (pt. 2), pp. 139-158.

NELSON, C. A. (1995) The ontogeny of human memory: a cognitive neuroscience perspective. **Developmental Psychology,** vol. 31 (pt. 5), pp. 723-738.

NINIO, J. (1988) A model of localized iconic memory, replicable and associative, using time sharing a 3 neuronal communication modes.**Comptes Rendus De L Academie Des Sciences. Serie III, Sciences De La Vie,** vol. 306 (pt. 18), pp. 545-550.

OSWALD, C.J., TREMBLAY, S., and JONES, D.M. (2000, September) Disruption of comprehension by the meaning of irrelevant sound. **Memory,** vol. 8 (pt. 5), pp. 345-350.

OWEN, A. M., HERROD, N. J., MENON, D. K., CLARK, J. C., DOWNEY, S. P., CARPENTER, T. A., MINHAS, P. S., TURKHEIMER, F. E., WILLIAMS, E. J., ROBBINS, T. W., SAHAKIAN, B. J., PETRIDES, M. and PICKARD, J. D. (1999, February) Redefining the functional organization of working memory processes within human lateral prefrontal cortex. **Eruopean Journal of Neuroscience,** vol. 11 (pt. 2), pp. 567-574.

PAMPHLETT, R., and MORRIS, J. (1983, July 9) Cortical hearing deficit. A deaf brain. **Medical Journal of Australia,** vol. 2 (pt. 1), pp. 35-36.

PANKSEPP, J., and BERNATZKY, G. (2002, November) Emotional sounds and the brain: the neuro-affective foundations of musical appreciation. **Behaviour Processes.** Vol. 60 (pt. 2), pp. 133-155.

PANTEV, C., OOSTENVELD, R., ENGELIEN, A., ROSS, B., ROBERTS, L. and HOKE, M. (1998, April 23) Increased auditory cortical representation in musicians. **Nature,** vol. 392 (pt. 6678), pp. 811-814.

PAOLINO, E., DE BASTIANI, P., MONETTI., V.C., BOLDRINI, P., and ROSATI, G. (1983, June) Pure "aphasic" agraphia due to damage of the left superior parietal lobule. **Italian Journal of Neurological Sciences.** Vol. 4 (pt. 2), pp. 233-237.

PAQUETTE, C. and PERETZ, I. (1997) Role of familiarity in auditory discrimination of musical instrument: a laterality study. **Cortex,** vol. 33 pp. 689-696.

PARKIN, A. J. (1987) **Memory and Amnesia-An Introduction,** Oxford, Basil Blackwell Ltd.

PARKIN, A.J. (1996, December) Human memory: the hippocampus is the key. **Current Biology,** vol. 6 (pt. 12), pp. 1583-1585.

PARKIN, A.J. (1999) **Memory-A Guide for Professionals,** Chichester, John Wiley & Sons, LTD.

PATEL, A. D., GIBSON, E., RATNER, J., BESSON, M., and HOLCOMB, P. (1998) Processing syntactic relations in language and music: a event-related potential study. **Journal of Cognitive Neuroscience,** vol.10 (pt. 6), pp. 717-733.

PERETZ, I. and MORAIS, J. (1979 December) A left-ear advantage for chords in non-musicians. **Perceptual and Motor Skills,** vol. 49 (pt. 3), pp. 957-958.

PERETZ, I. (1985) Hemispheric asymmetry in amusia. **Revue Neurologique,** vol. 141 (pt. 3), pp. 169-183.

PERETZ, I. (1990) Processing of local and global musical information by unilateral brain-damaged patients. **Brain,** vol. 113 pp. 1185-1205.

PERETZ, I. and BABAI, M. (1992, March) The role of contour and intervals in the recognition of melody parts: evidence from cerebral asymmetries in musicians. **Neuropsychologia,** vol. 30 (pt. 3), pp. 277-292.

PERETZ, I. and KOLINSKY, R. (1993) Boundaries of separability between melody and rhythm in music discrimination: a neuropsychological perspective. **The Quarterly Journal of Experimental Psychology,** vol. 46a (pt. 2), pp. 301-325.

PERETZ, I., KOLINSKY, R., TRAMO, M., LABRECQUE, R., HUBLET, C., DEMEURISSE, G. and BELLEVILLE, S. (1994) Functional dissociations following bilateral lesions of auditory cortex. **Brain,** vol. 117 pp. 1283-1301.

PERETZ, I., BELLEVILLE, S. and FONTAINE, S. (1997) Dissociations between music and language functions after cerebral resection: A new case of amusia without aphasia.

Canadian Journal of Experimental Psychology, December; vol. 51 (pt. 4), pp. 354-68.

PERETZ, I., GAUDREAU, D. and BONNEL, A. M. (1998 September) Exposure effects on music preference and recognition. **Memory and Cognition,** vol. 26 (pt. 5), pp. 884-902.

PERETZ, I., AYOTTE, J., ZATORRE, R., MEHLER, J., AHAD, P., PENHUNE, V.B., and JUTRAS, B. (2002, January 17) Congenital amusia: a disorder of fine-grained pitch discrimination. **Neuron,** vol. 33 (pt. 2), pp. 185-191.

PERETZ, I. (2002, August) Brain specialization for music. **Neuroscientist,** vol.8 (pt. 4), pp. 372-380.

PEYNIRCIOGLU, Z. F., TEKCAN, A. I., WAGNER, J. L., BAXTER, T. L. and SHAFFER, S. D. (1998 November) Name or hum that tune: feeling of knowing for music. **Memory and Cognition,** vol. 26 (pt. 6), pp. 1131-1137.

PICCIRILLI, M., SCIARMA, T., and LUZZI, S. (2000, October) Modularity of music: evidence from a case of pure amusia. **Journal of Neurology, Neurosurgery, and Psychiatry,** vol. 69 (pt. 4), pp. 541-545.

PILLEMER, D. B. (1998 December) What is remembered about early childhood events? **Clinical Psychology Review,** vol. 18 (pt. 8), pp. 895-913.

PLATEL, H., PRICE, C., BARON, J. C., WISE, R., LAMBERT, J., FRACKOWIAK, R. S., LECHEVALIER, B. and EUSTACHE, F. (1997) The structural components of music perception. A functional anatomical study. **Brain,** February; vol. 120 (pt. 2), pp. 229-243.

PLENGER, P. M., BREIER, J. L., WHELESS, J. W., RIDLEY, T. D., PAPANICOLAOU, A. C., BROOKSHIRE, B., THOMAS, A., CURTIS, V. and WILLMORE, L. J. (1996) Lateralization of memory for music: evidence from the intracarotid sodium amobarbital procedure. **Neuropsychologia,** October; vol. 34 (pt. 10), pp. 1015-1018.

POLANYI, M. (1962) Tacit knowing: it's bearing on some problems of philosophy. **Review of Modern Physics,** vol. 34 pp. 601-616.

POLK, M. and KERTESZ, A. (1993) Music and language in degenerative disease of the brain. **Brain and Cognition,** vol. 22 pp. 98-117.

~~POORE, S. (2000) Ethnometodology. http://www.hewett.norfolk.sch.uk/curric/soc/ethno/intro.html (15 September, 2000).~~

PREIS, S., JANCKE, L., SCHITTLER, P., HUANG, Y. and STEINMETZ, H. (1998, September) Normal intrasylvian anatomical asymmetry in children with developmental language disorder. **Neuropsychologia,** vol. 36 (pt. 9), pp. 849-855.

PRIESLER, A., GALLASCH, E., and SCHULTER, G. (1989, July) Hemispheric asymmetry and the processing of harmonies in music. **International Journal of**

Neuroscience, vol. 47 (pt. 1-2), pp. 131-140.

PSATHAS, G. (1972) Ethnoscience and Ethnomethodology. In: SPRADLEY, J. ed. **Culture and Cognition: Rules, Maps, and Plans.**, San Francisco, Chandler Publishing Company.

RADVANSKY, G. A., FLEMING, K. J. and SIMMONS, J. A. (1984) Timbre reliance in nonmusicians' and musicians' memory for melodies. **Music Perception,** pp. 127-139.

RADVANSKY, G.A., and POTTER, J.K (2000, July) Source cuing: memory for melodies. . **Memory & Cognition,** vol. 28 (pt. 5), pp. 693-699.

RAHN, J.E. (1984) **Ears, Hearing, and Balance,** New York, Atheneum

RAUSCHER, F., SHAW, G. and KY, K. (1995, February 6) Listening to Mozart enhances spatial-temporal reasoning: towards a neurophysiological basis. **Neuroscience Letters,** vol. 185 (pt. 1), pp. 44-47.

RAUSCHER, F. H., ROBINSON, K. D. and JENS, J. J. (1998) Improved maze learning through early music exposure in rats. **Neurological Research,** July; vol. 20 (pt. 5), pp. 427-432.

RAUSCHER, F. H., SHAW, G. L., LEVINE, L. J., WRIGHT, E. L., DINNIS, W. R. and NEWCOMB, R. L. (1997, February) Music training causes long-term enhancement of preschool children's spatial-temporal reasoning. **Neurological Research,** vol. 19 (pt. 1), pp. 2-8.

RAUSCHER, F. H. and SHAW, G. L. (1998) Key components of the Mozart effect. **Perceptual and Motor Skills,** June; vol. 86 (pt. 1), pp. 835-841.

REEVES, D. and WEDDING, D. (1994) The Neuroanatomy of Memory. In: ed. **The Clinical Assessment of Memory: A Practical Guide**, New York, Springer Publishing Company.

REEVES, D. and WEDDING, D. (1994) **The Clinical Assessment of Memory-A Practical Guide,** New York, Springer Publishing Company.

RESNICOFF, M. (1995, May) The 12-point star: a conversation with Pat Martino. **Guitar Player,** vol. 29 (pt. 5), p. 136.

RESNICOFF, M. (1995, September) Pat Martino meets his maker; the resurrection of a jazz legend. (Interview). **Guitar Player,** vol. 29 (pt. 9), p. 39-43.

RIDEOUT, B. E. and LAUBACH, C. M. (1996) EEG correlates of enhanced spatial performance following exposure to music. **Perceptual and Motor Skills,** vol. 82, pp. 427-432.

RIDEOUT, B. E. and TAYLOR, J. (1997) Enhanced spatial performance following 10

minutes exposure to music: a replication. **Perceptual and Motor Skills,** August; vol. 85 (pt. 1), pp. 112-114.

RIDEOUT, B. E., DOUGHERTY, S. and WERNERT, L. (1998) Effect of music of spatial performance: a test of generality. **Perceptual and Motor Skills,** April; vol. 86 (pt. 2), pp. 512-4.

RIDEOUT, B. and TAYLOR, J. (1997, August) Enhanced spatial performance following 10 minutes exposure to music: a replication. **Perceptual Motor Skills,** vol. 85 (pt. 1), pp. 112-114.

ROESER, R. J. and DALY, D. D. (1974, June) Auditory cortex disconnection associated with thalamic tumor. **Neurology**, vol. pp. 555-559.

ROUTH, D.A. AND MAYES, J.T. (1974) On consolidation and the potency of delayed stimulus suffices. **Quarterly Journal of Experimental Psychology,** v. 26, pp. 472-479.

ROSATI, G., BASTIANI, P. D., PAOLINO, E., PROSSER, S., ARSLAN, E. and ARTIOLI, M. (1982) Clinical and audiological findings in a case of auditory agnosia. **Journal of Neurology,** vol. 227 (pt. 1), pp. 21-27

RUBIN, D. C., RAHHAL, T. A. and POON, L. W. (1998) Things learned in early adulthood are remembered best. **Memory and Cognition,** January; vol. 26 (pt. 1), pp. 3-19.

RUMSEY, J. M., DONOHUE, B. C., BRADY, D. R., NACE, K., GIEDD, J. N. and ANDREASON, P. (1997, December) A magnetic resonance imaging study of planum asymmetry in men with developmental dyslexia. **Archives of Neurology**, vol. 54, pp. 1481-1489.

RYBASH, J. M. and MONAGHAN, B. E. (1999 January) Episodic and semantic contributions to older adults' autobiographical recall. **Journal of General Psychology**, vol. 126 (pt. 1), pp. 85-96.

SACARIN, L. (2003) **Tomatis Effect - A Unique Listening Training or Auditory Integration Method, http://www.listeninglearning.com/,** 3 October 2003.

SACKS, O. (1985) **The Man Who Mistook His Wife for a Hat,** New York, Summit Books.

SAFFRAN, J.R., LOAN, M.M., ROBERTSON, R.R (2000, October 16) Infant memory for musical experiences. **Cognition,** vol. 77 (1), pp. B15-B23.

SANES, J.N. (2000) Motor cortex rules for learning and memory. **Current Biology,** vol. 10, pp. R495-R497.

SARNTHEIN, J., VONSTEIN, A., RAPPELSBERGER, P., TETSCHE, H., RAUSCHER, F. H. and SHAW, G. L. (1997, April) Persistent patterns of brain activity: an EEG

coherence study of the positive effect of music on spatial-temporal reasoning. **Neurological Research,** vol. 19 (pt. 2), pp. 107-116.

SARNTHEIN, J., PETSCHE, H., RAPPELSBERGER, P., SHAW, G. L. and STEIN, A. V. (1998, June 9) Synchronization between prefrontal and posterior association cortex during human working memory. **Proceedings of the National Academy of Sciences of the United States of America,** vol. 95 (pt. 12), pp. 7092-7096.

SAUGSTAD, L. F. (1998, January) Cerebral lateralisation and rate of maturation. **International Journal of Psychophysiology,** vol. 28 (pt. 1), pp. 37-62.

SAUZEON, H., N'KAOUA, B., LESPINET, V., GUILLEM, F., AND CLAVERIE, B. (2000, January/March) Age effect in recall performance according to the levels of processing, elaboration, and retrieval cues. **Experimental Aging Research,** vol. 26 (pt. 1), pp. 57-73.

SCHACTER, D.L. (1996) **Searching For Memory-The Brain, The Mind, and the Past,** New York, Harper Collins Publishers.

SCHILL, K. and ZETZSCHE, C. (1995) A model of visual spatio-temporal memory: the icon revisited. **Psychological Research,** vol. 57 (pt. 2), pp. 88-102.

SCHLAUG, G., JANCKE, L., HUANG, Y., STAIGER, J. and STEINMETZ, H. (1995, August) Increased corpus callosum size in musicians. **Neuropsychologia,** vol. 33 (pt. 8), pp. 1047-1055.

SCHLAUG, G., JANCKE, L., HUANG, Y., STAIGER, J. and STEINMETZ, H. (1995, February) In vivo evidence of structural brain asymmetry in musicians. **Science,** vol. 267 (pt. 5198), pp. 699-701.

SCHOOL OF ALLIED HEALTH SCIENCES AT THE MEDICAL COLLEGE OF GEORGIA (2000) Wernicke's Area. http://synergy.mcg.edu/pt/PT413/images/579.gif (23 August, 2000).

SCHUPPERT M., MUNTE, T.F., B.M. WIERINGA., ALTENMULLER, E. (2000, March) Receptive amusia: evidence for cross-hemispheric neural networks underlying music processing strategies. **Brain,** vol.123 (Pt 3), pp. 546-559.

SEIBERT, P.S., FEE, L., BASOM, J., ZIMMERMAN, C. (2000, March) Music and the brain: the impact of music on an oboist's fight for recovery. **Brain Injury,** vol. 14 (pt. 3) pp. 295-302.

SEMRUD-CLIKEMAN, M. (1997, June) Evidence from imaging on the relationship between brain structure and developmental language disorders. **Seminars in Pediatric Neurology,** vol. 4 (pt. 2), pp. 117-124.

SERAFINE, M. L. (1981) Musical timbre imagery in young children. **The Journal of Genetic Psychology**, vol. 139, pp. 97-108.

SERGENT, J., ZUCK, E., TERRIAH, S. and MACDONALD, B. (1992, July) Distributed neural network underlying musical sight-reading and keyboard performance. **Science,** vol. 257 (pt. 5066), pp. 106-109.

SERGENT, J. (1993, May) Music, the brain and Ravel. **Trends in Neuroscience,** vol. 16 (pt. 5), pp. 168-172.

SHAMMI, P. and STUSS, D. T. (1999, April) Humour appreciation: a role of the right frontal lobe. **Brain,** vol. 122 (pt. 4), pp. 657-666.

SHAPLESKE, J., ROSSELL, S. L., WOODRUFF, P. W. and DAVID, A. S. (1999, January) The planum temporale: a systematic, quantitative review of its structural, functional and clinical significance. **Brain Research. Brain Research Reviews,** vol. 29 (pt. 1), pp. 26-49.

SHARPS, M.J., and POLLITT, B.K. (1998, April) Category superiority effects and the processing of auditory images. **Journal of General Psychology,** vol. 125 (pt. 2), pp. 109-116.

SHIMIZU, H. (1987) The relationship between memory performance and the number of rehearsals in free recall. **Memory and Cognition,** vol. 15 (pt. 2), pp. 141-147.

SCHUPPERT, M., MUNTE, T.F., WIERINGA, B.M., and ALTENMULLER, E. (2000, March) Receptive amusia: evidence for cross-hemispheric neural networks underlying music processing strategies. **Brain,** vol. 123 (pt. 3), pp. 546-559.

SILVERSTEIN, A. (1999) The brain tumor of George Gershwin and the legs of Cole Porter. **Seminars in Neurology,** vol. 19 suppl 1, pp. 3-9.

SLUMING, V., BARRICK, T., HOWARD, M., CEZAYIRLI, E., MAYES, A., and ROBERTS, N. (2002, November) Voxel-based morphometry reveals increased gray matter density in Broca's area in male symphony orchestra musicians. **Neuroimage,** vol. 17 (pt. 3), pp. 1613-1622.

SMITH, E. E., JONIDES, J., MARSHUETZ, C. and KOEPPE, R. A. (1998, February 3) Components of verbal working memory: evidence from neuroimaging. **Proceedings of the National Academy of Sciences of the United States of America,** vol. 95 (pt. 3), pp. 876-882.

SMITH, E. E. and JONIDES, J. (1999, March 12) Storage and executive processes in the frontal lobes. **Science,** vol. 283 (pt. 5408), pp. 1657-1661.

SMITH, E. and JONIDES, J. (1998, September 29) Neuroimaging analyses of human working memory. **Proceedings of the National Academy of Sciences of the United States of America,** vol. 95 (pt. 20), pp. 12061-12068.

SMITH, J., WILSON, M. and REISBERG, D. (1995, November) The role of

subvocalization in auditory imagery. **Neuropsychologia,** vol. 33 (pt. 11), pp. 1433-1454.

SNYDER, P. J., NOVELLY, R. A. and HARRIS, L. J. (1990, October 12) Mixed speech dominance in the intracarotid sodium amytal procedure: validity and criteria issues. **Journal of Clinical Experimental Neuropsychology,** vol. 12 (pt. 5), pp. 629-643.

SNYDER, P. J. and HARRIS, L. J. (1997, February) The intracarotid amobarbital procedure: an historical perspective. **Brain and Cognition,** vol. 33 (pt. 1), pp. 18-32.

SOLLIER, P. (2003) **The Tomatis Method,** http://www.tomatis.com/English/index.htm, 3 October 2003

SPRADLEY, J. P. (1979) **The Ethnographic Interview,** New York, Holt, Rinehart and Winston.

SPRINGER, S. P. and DEUTSCH, G. (1998) **Left Brain, Right Brain-Prospectives From Cognitive Neuroscience,** San Francisco, W.H. Freeman and Company.

SQUIRE, L. R. (1987) **Memory and Brain,** New York, Oxford University Press.

SQUIRE, L. R. (1991, April) Memory and the hippocampus: a synthesis from findings with rats, monkeys, and humans. **Psychological Review,** vol. 99 (pt. 2), pp. 195-231.

ST LOUIS, E.K. (1999) Musical tradition, insurrection, and resurrection: the life and legacy of composer/bassist Charles Mingus. **Seminars in Neurology,** v 19 Suppl 1, pp. 25-28.

STEELE, K. M., BALL, T. N. and RUNK, R. (1997) Listening to Mozart does not enhance backwards digit span performance. **Perceptual and Motor Skills,** vol. 84, pp. 1179-1184.

STEELE K.M., BROWN J.D., STOECHER, J.A. (1999, June) Failure to confirm the Rauscher and Shaw description of recovery of the Mozart effect. **Perceptual and Motor Skills,** vol. 88 (3 pt.1), pp. 843-848.

STEINMETZ, H., VOLKMANN, J., JANCKE, L. and FREUND, H. J. (1991, March) Anatomical left-right asymmetry of language-related temporal cortex is different in left and right handers. **Annals of Neurology,** vol. 29 (pt. 3), pp. 315-319.

STEINMETZ, H. (1996, Winter) Structure, functional and cerebral asymmetry: in vivo morphometry of the planum temporale. **Neuroscience and Biobehavioral Reviews,** vol. 20 (pt. 4), pp. 587-591.

STRAUSS, A., and CORBIN, J. (1990) **Basics of Qualitative Research,** London, Sage Publications.

STUTT, H (1983) The Tomatis Question: A review of current research. **Unpublished Manuscript,** McGill University, Montreal, Quebec.

SUDNOW, D. (2001) **Ways of the Hand,** Cambridge, The MIT Press.

SWANSON, H. L. (1999, January) Reading comprehension and working memory in learning-disabled readers: is the phonological loop more important than the executive system? **Journal of Experimental Child Psychology,** vol. 72 (pt. 1), pp. 1-31.

TAKAHASHI, N., KAWAMURA, M., SHINOTOU, H., HIRAYAMA, K., KAGA, K., and SHINDO, M. (1992, June) Pure word deafness due to left hemisphere damage. **Cortex,** vol. 28 (pt.2), pp. 295-303.

TAKEDA, K., BANDOU, M. and NISIMURA, Y. (1990, January) Motor amusia following a right temporal lobe hemorrhage-a case report. **Rinsho Shinkeigaku,** vol. 30 (pt. 1), pp. 78-83.

TASAKI, H. (1982, November) Perception of music stimuli by the Dichotic Listening Test-studies on college students making a specialty of music. **No To Shinkei,** vol. 34 (pt. 11), pp. 1051-1057.

TERVANIEMI, M., ILVONEN, T., KARMA, K., ALHO, K. and NAATANEN, R. (1997, April 18) The musical brain: brain waves reveal the neurophysiological basis of musicality in human subjects. **Neuroscience Letters,** vol. 226 (pt. 1), pp. 1-4.

TERVANIEMI, M., KUJALA, A., ALHO, K., ILMONIEMI, R. J. and NAATANEN, R. (1999 March) Functional specialization of the human auditory cortex in processing phonetic and musical sounds: a magnetoencephalographic (MEG) study. **Neuroimage,** vol. 9 (pt. 3), pp. 330-336.

THAUT, M. H., KENYON, G. P., SCHAUER, M. L. and MCINTOSH, G. C. (1999 March-April) The connection between rhythmicity and brain function. **IEEE Engineering in Medicine and Biology Magazine,** vol. 18 (pt. 2), pp. 101-108.

THOMPSON, B.M., AND ANDREWS, S.R. (1999, Mar-Apr) The emerging field of sound training. IEEE engineering in medicine and biology magazine : **The Quarterly Magazine Of The Engineering In Medicine & Biology Society,** vol. 18 (2), pp.89-96,

THOMPSON, B.M., AND ANDREWS, S.R. (2000, Jul-Sep) An historical commentary on the physiological effects of music: Tomatis, Mozart and neuropsychology, **Integrative Physiological And Behavioral Science : The Official Journal Of The Pavlovian Society,** vol. 35 (pt. 3), pp. 174-188.

TODD, N.P. and CODY, F.W. (2000, January), Vestibular responses to loud dance music: a physiological basis of the "rock and roll threshold?" **Journal of the Acoustical Society of America,** vol 107 (1), pp.496-500.

TOGLIA, M.P., NEUSCHATZ, J.S. AND GOODWIN, K.A. (1999, March) Recall accuracy and illusory memories: when more is less. **Memory,** vol. 7 (pt.2), pp. 233-256.

TOMATIS, A. (1991) **The Conscious Ear,** Barrytown, Station Hill Press.

TOMATIS, A. (1996) **The Ear and Language,** Ontario, Moulin Publishing.

TRAMO, M.J., and BHARUCHA, J.J. (1991) Musical priming by the right hemisphere post-callosotomy. **Neuropsycologia,** vol. 29 (pt. 4), pp. 313-325.

TREHUB, S. E., BULL, D. and THORPE, L. A. (1984) Infants perception of melodies: the role of melodic contour. **Child Development**, vol. 55, pp. 821-830.

TREHUB, S. E. (1987) Infants' perception of musical patterns. **Perception & Psychophysics,** vol. 41 (pt. 6), pp. 635-641.

TRENERRY, M. R. and LORING, D. W. (1995, November) Intracarotid amobarbital procedure. The Wada test. **Neuroimaging Clinician of North America,** vol. 5 (pt. 4), pp. 721-728.

TULVING, E. (1972) Episodic and Semantic Memory. In: TULVING, E. and DONALDSON, W. ed. **Organization of memory**, New York, Academic Press.

TULVING, E. (1985, April) How many memory systems are there? **American Psychologist,** pp. 385-398.

TULVING, E. (1985, July-August) Remembering and knowing the past. **American Scientist**, vol. 77, pp. 361-367

TULVING, E. (1991) Concepts of Human Memory. In: SQUIRE, L., WEINBERGER, N. M., LYNCH, G. and MCGAUGH, J. L. ed. **Memory: Organization and Locus of Change**, Oxford, Oxford University Press. pp. 186-213.

TZORTZIS, C., GOLDBLUM, M.C., DANG, M., FORETTE, F., and BOLLER, F. (2000, April) Absence of amusia and preserved naming of musical instruments in an aphasic composer. **Cortex,** vol. 36 (pt. 2), pp. 227-242.

TZOURIO, N., CRIVELLO, F., MELLET, E., NKANGA-NGILA, B. and MAZOYER, B. (1998, July) Functional anatomy of dominance for speech comprehension in left-handers vs. right-handers. **Neuroimage,** vol. 8 (pt. 1), pp. 1-16.

TZOURIO, N., NKANGA-NGILA, B. and MAZOYER, B. (1998, March 30) Left planum temporale surface correlates with functional dominance during story listening. **Neuroreport,** vol. 9 (pt. 5), pp. 829-833.

UNIVERSITY OF CENTRAL FLORIDA (2000)
http://pegasus.cc.ucf.edu/~Brainmd1/brmodelc.gif (23 August, 2000).

(THE) VESTIBULAR DISORDERS ASSOCIATION (1996) Inner Ear Anatomy.
http://www.teleport.com/~veda/gifs/anatomy.gif (23 August, 2000)

VAN JAARSVELD, P.E., DU PLESSIS, W.F. (1988) Audio-psycho-phonology at Potshefstroom: A Review, **South African journal of psychology. Suid-Afrikaanse tydskrif vir sielkunde.** vol. 18 (pt.4), pp. 136-143.

VETULANI, J. (1999) Biology of memory. **Neurologia I Neurochirurgia Polska (Supplement),** vol. 33 (pt. 1), pp. 19-28.

VOLLMER-HAASE, J., FINKE, E., HARTJE, W., and BULLA-HELLWIG, M. (1998, September) Hemispheric dominance in the processing of J.S. Bach fugues: a transcranial Doppler sonography (TCD) study with musicians. **Neuropsychologia,** vol. 36 (pt. 9), pp. 857-867.

WALLENSTEIN, G.V., EICHENBAUM, H., and HASSELMO, M.E. (1998, August) The hippocampus as an associator of discontiguous events. **Trends in Neuroscience,** vol. 21 (pt. 8), pp. 317-323.

WATKINS, O. C. and WATKINS, M. J. (1980, September) The modality effect and echoic persistence. **Journal of Experimental Psychology: General,** vol. 109 (pt. 3), pp. 251-278.

WATKINS, A. J. (1985) Scale, key, and contour in the discrimination of tuned and mistuned approximations to melody. **Perception and Psychophysics,** vol. 37 (pt. 4), pp. 275-285.

WEEKS, R. A., AZIZ-SULTAN, A., BUSHARA, K. O., TIAN, B., WESSINGER, C. M., DANG, N., RAUSCHECKER, J. P. and HALLETT, M. (1999 March 12) A PET study of human auditory spatial processing. **Neuroscience Letters,** vol. 262 (pt. 3), pp. 155-158.

WEINBERGER, N. M. (1998, July) Physiological memory in primary auditory cortex: characteristics and mechanisms. **Neurobiology of Learning and Memory,** vol. 70 (pt. 1-2), pp. 226-251.

WEISER, H.G., and MAZZOLA, G. (1986) Musical consonances and dissonances: are they distinguished independently by the right and left hippocampi? **Neuropsychologia,** vol. 24 (pt. 6), pp. 805-812.

WERTHEIM, N. (1977) Is there an anatomical localisation for musical faculties? In: CRITCHLEY, M. and HENSON, R. ed. **Music and the Brain (Studies in the Neurology of Music),** London, William Heinemann Medical Books Limited, pp. 282-300.

WERTHEIMER, L. (1997, November 28) (Radio Host) **All Sides Now** (review of CD by Pat Martino), Washington D.C.: All Things Considered, National Public Radio.

WHITEHEAD, K. (1988, June) Review-Pat Martino. **Down Beat,** p. 14.

WILDGRUBER, D., KISCHKA, U., ACKERMANN, H., KLOSE, U. and GRODD, W. (1999, January) Dynamic pattern of brain activation during sequencing of word strings

evaluated by fMRI. **Brain Research. Cognitive Brain Research,** vol. 7 (pt. 3), pp. 285-294.

WILSON, B.C., METLAY,W., and RISUCCI,D (1982, September 20) Tomatis Project Final Report. Unpublished Report.

WINKLER, I. and NAATANEN, R. (1992, June 22) Event-related potentials in auditory backward recognition masking: a new way to study the neurophysiological basis of sensory memory in humans. **Neuroscience Letters,** vol. 140 (pt. 2), pp. 239-242.

WINKLER, I., PAAVILAINEN, P. and NAATANEN, R. (1992, May) Can echoic memory store two traces simultaneously? A study of event-related brain potentials. **Psychophysiology,** vol. 29 (pt. 3), pp. 337-349.

WINKLER, I., REINIKAINEN, K. and NAATANEN, R. (1993, April) Event-related brain potentials reflect traces of echoic memory in humans. **Perception and Psychophysics,** vol. 53 (pt. 4), pp. 443-449.

WINKLER, I., CZIGLER, I., JARAMILLO, M., PAAVILAINEN, P. and NAATANEN, R. (1998, February 16) Temporal constraints of auditory event synthesis: evidence from ERP's. **Neuroreport,** vol. 9 (pt. 3), pp. 495-499.

WINKLER, I., TERVANIEME, M., SCHROGER, E., WOLFF, C. and NAATANEN, R. (1998, February 6) Preattentive processing of auditory spatial information in humans. **Neuroscience Letters,** vol. 242 (pt. 1), pp. 49-52.

YAMADORI, A., OSUMI, Y., MASUHARA, S., and OKUBO, M. (1977, March) Preservation of singing in Broca's aphasia. **Journal of Neurology, Neurosurgery, and Psychiatry,** vol. 40 (pt. 3), pp. 221-224.

YOUNG, R.L., and NETTELBECK, T. (1995, June) The abilities of a musical savant and his family. **Journal of Autism and Developmental Disorders,** vol. 25 (pt. 3), pp. 231-248.

ZATORRE, R. J. (1984, Winter) Musical perception and cerebral function: a critical review. **Music Perception,** vol. 2 (pt. 2), pp. 196-221.

ZATORRE, R. J. (1989) Perceptual asymmetry on the dichotic fused words test and cerebral speech lateralization determined by the carotid sodium amytal test. **Neuropsychologia,** vol. 27 (pt. 10), pp. 1207-1219.

ZATORRE, R.M. (1989, December) Intact absolute pitch ability after left temporal lobectomy. **Cortex,** vol. 25 (pt. 4), pp. 567-580.

ZATORRE, R. J., EVANS, A. C. and MEYER, E. (1994, April) Neural mechanisms underlying melodic perception and memory for pitch. **Journal of Neuroscience,** vol. 14 (pt. 4), pp. 1908-1919.

ZATORRE, R. J., PTITO, A. and VILLEMURE, J. G. (1995, August) Preserved auditory spatial localization following cerebral hemispherectomy. **Brain,** vol. 118 (pt. 4), pp. 879-889.

ZATTORE, R. J., PERRY, D. W., BECKETT, C. A., WESTBURY, C. F. and EVANS, A. C. (1998, March) Functional anatomy of musical processing in listeners with absolute pitch and relative pitch. **Proceedings of the National Academy of Sciences of the United States of America,** vol. 95 (pt. 6), pp. 3172-3177.

Background Reading

ABE, K., UKITA, H. and YANAGIHARA, T. (1997, August) Imaging in primary progressive aphasia. **Neuroradiology,** vol. 39 (pt. 8), pp. 556-559.

ABOO-BAKER, F. and LABAUGE, R. (1987) Alexia and agraphia caused by a lesion of the right hemisphere in a non-aphasic right-handed patient. **Revue Neurologique,** vol. 143 (pt. 4), pp. 294-297.

ALHO, K., CONNOLLY, J. F., CHEOUR, M., LEHTOKOSKI, A., HUOTILAINEN, M., VIRTANEN, J., AULANKO, R. and ILMONIEMI, R. J. (1998, December 11) Hemispheric lateralization in preattentive processing of speech sounds. **Neuroscience Letters,** vol. 258 (pt. 1), pp. 9-12.

ALHO, K., WINKLER, I., ESCERA, C., HUOTILAINEN, M., VIRTANEN, J., JAASKELAINEN, I. P., PEKKONEN, E. and ILMONIEMI, R. J. (1998, March) Processing of novel sounds and frequency changes in the human auditory cortex: magnetoencephalographic recordings. **Psychophysiology,** vol. 35 (pt. 2), pp. 211-224.

AMENEDO, E. and DIAZ, F. (1998, July) Automatic and effortful processes in auditory memory reflected by event-related potentials. Age related findings. **Electroencephalography and Clinical Neurophysiology,** vol. 108 (pt. 4), pp. 361-369.

ANDERSEN, P. (1998, December 10) Organization and substrate of memory. **Tidsskrift Nor Den Norske Laegeforening,** vol. 118 (pt. 30), pp. 4729-4735.

ARCINIEGAS, D., ADLER, L., TOPKOFF, J., CAWTHRA, E., FILLEY, C. M. and REITE, M. (1999, January) Attention and memory dysfunction after traumatic brain injury: cholinergic mechanisms, sensory gating, and a hypothesis for further investigation. **Brain Injury,** vol. 13 (pt. 1), pp. 1-13.

ARDILA, A. (1984) Right Hemisphere Participation in Language. In: ARDILA, A. and OSTROSKY-SOLIS, F. ed. **The Right Hemisphere-Neurology and Neuropsychology,** New York, Gordon and Breach.
pp. 99-107.

ARDILA, A. (1993, May) Toward a model of phoneme perception. **International Journal of Neuroscience,** vol. 70 (pt. 1-2), pp. 1-12.

ASSAL, G. and BUTTET, J. (1983) Agraphia and preservation of music writing in a bilingual piano teacher. **Revue Neurologique,** vol. 139 (pt. 10), pp. 569-574.

AUZOU, P., EUSTACHE, F., ETEVENON, P., PLATEL, H., RIOUX, P., LAMBERT, J., LECHEVALIER, B., ZARIFIAN, E., and BARON, J.C. (1995, January) Topographic EEG activations during timbre and pitch discrimination tasks using musical sounds. **Neuropsychologia,** vol. 33, (pt. 1), pp. 25-37.

BADDELEY, A. and HITCH, G. (1974) Working Memory. In: BOWER, G. ed. **The Psychology of Learning and Motivation**, New York, Academic Press. pp. 47-90.

BADDELEY, A., PAPAGNO, C. and VALLAR, G. (1988) When long-term memory depends on short-term storage. **Journal of Memory and Language,** vol. 27, pp. 586-595.

BADDELEY, A. (1995) Memory. In: FRENCH, C. C. and COLMAN, A. M. ed. **Cognitive Psychology**, London, Longman. pp. 1-21.

BADDELEY, A., ERNSLIE, H., KOLODNY, J. and DUNCAN, J. (1998, November) Random generation and the executive control of working memory. **Quarterly Journal of Experimental Psychology. A Human Experimental Psychology,** vol. 51 (pt. 4), pp. 819-852.

BALABAN, M. T., ANDERSON, L. M. and WISNIESKI, A. B. (1998) Lateral asymmetries in infant melody perception. **Developmental Psychology,** January; vol. 34 (pt. 1), pp. 39-48.

BARNES, M.P. (1999) Rehabilitation after traumatic brain injury. **British Medical Bulletin.** Vol. 55 (pt. 4), pp. 927-943.

BARONI, C. D. (1997, May) The pathobiography and death of Wolfgang Amadeus Mozart: from legend to reality. **Human Pathology,** vol. 28 (pt. 5), pp. 519-521.

BARRETT, K. A. and FULFS, J. M. (1998, December) Effect of gender on the mismatch negativity auditory evoked potential. **Journal of the American Academy of Audiologists,** vol. 9 (pt. 6), pp. 444-451.

BARSALOU, L. W. (1993) Flexibility, structure, and linguistic vagary in concepts: manifestations of a compositional system of perceptual symbols. In: COLLINS, A. F., GATHERCOLE, S. E., CONWAY, M. A. and MORRIS, P. E. ed. **Theories of Memory**, Hove, Lawrence Erlbaum Associates Ltd. pp. 29-101.

BARTLETT, J. C. and DOWLING, W. J. (1980) Recognition of transposed melodies: a key-distance effect in developmental perspective. **Journal of Experimental Psychology: Human Perception and Performance,** vol. 6 (pt. 3), pp. 501-515.

BEGLEY, S. (1996, February 19) Your Child's Brain. **Newsweek**, pp. 55-62.

BELIN, P., EECKHOUT, P. V., ZILBOVICIUS, M., REMY, P., FRANCOIS, C., GUILLAUME, S., CHAIN, F., RANCUREL, G. and SAMSON, Y. (1996, December) Recovery from nonfluent aphasia after melodic intonation therapy: a PET study. **Neurology,** vol. 47 (pt. 6), pp. 1504-1511.

BELIN, P., ZILBOVICIUS, M., CROZIER, S., THIVARD, L., FONTAINE, A., MASURE, M. C. and SAMSON, Y. (1998, July) Lateralization of speech and auditory temporal processing. **Journal of Cognitive Neuroscience,** vol. 10 (pt. 4), pp. 536-540.

BERZ, W. L. (1995) Working Memory in Music. **Music Perception,** Spring; vol. 12 (pt. 3). pp. 353-364.

BESSON, M., FAITA, F. and REQUIN, J. (1994, February 28) Brain waves associated with musical incongruities differ for musicians and non-musicians. **Neuroscience Letters,** vol. 168 (pt. 1-2),
pp. 101-105.

BEVERSDORF, D. and HEILMAN, K. (1988) Progressive ventral posterior cortical degeneration presenting as alexia for music and words. **Neurology,** March; vol. 50, (pt. 3). pp. 657-9.

BHARUCHA, J. J. (1994) Tonality and Expectation. In: AIELLO, R. and SLOBODA, J. A. ed. **Musical Perceptions**, New York, Oxford University Press. pp. 213-39.

BIGLER, E. D. (1996, September 1) Brain imaging and behavioural outcome in traumatic brain injury. **Journal of Learning Disabilities,** vol. 29 (pt. 1), pp. 515-531.

BLAU, J. N. and HENSON, R. A. (1977) Neurological disorders in performing musicians. In: CRITCHLEY, M. and HENSON, R. A. ed. **Music and the Brain**, London, William Heinemann Medical Books, Ltd. pp. 301-322.

BOTEZ, M.L., AND WERTHEIM, N. (1959). Expressive aphasia and amusia following right frontal lesion in a right-handed man. **Brain**, vol. 82, pp. 186-202.

BOGEN, J. E. and GORDON, H. W. (1971) Musical tests for functional lateralization with intracarotid amobarbital. **Nature,** April 23; vol. 230 pp. 524-5.

BOLTZ, M. (1991) Some structural determinants of melody and recall. **Memory and Cognition,** vol. 19 (pt. 3), pp. 239-251.

BOLTZ, M. G. (1998, August) The processing of temporal and nontemporal information in the remembering of event durations and musical structure. **Journal of Experimental Psychology-Human Perception and Performance,** vol. 24 (pt. 4), pp. 1087-104.

BORCHGREVINK, H. M. (1993, December 10) Music, brain and medicine. **Tidsskrift Nor Den Norske Laegeforening,** vol. 113 (pt. 30), pp. 3743-3747.

BOTTAZZI, A. M. T. D. (1978) **To Live Again,** New York, Dodd, Mead and Company.

BOYLE, J.D. & RADOCY, R.E. (1987) **Measurement and Evaluation of Musical Experiences.** New York, Schirmer Books.

BREITLING, D., GUENTHER, W. and RONDOT, P. (1987) Auditory perception of music measured by brain electrical activity mapping. **Neuropsychologia**, vol. 25 (pt. 5), pp. 765-774.

BROADBENT, D. E., COOPER, P. J., FRANKISH, C. R. and BROADBENT, M. H. (1980, November) Modality differences in relation to grouping in immediate recall. **British Journal of Psychology,** vol. 71 (pt. 4), pp. 475-485.

BROWN, E. (1997) A Luscious Guitar Sound. **Fortune,** October; vol. 136 (pt. 7), pp. 52.

BRUST, J. C. M. (1980) Music and language: musical alexia and agraphia. **Brain,** vol. 103 pp. 367-92.

BURTON, A., MORTON, N. and ABBESS, S. (1989, May) Mode of processing and hemisphere differences in the judgment of musical stimuli. **British Journal of Psychology**, vol. 80 (pt. 2), pp. 169-180.

CABEZA, R., and NYBERG, L. (2000, August) Neural bases of learning and memory: functional neuroimaging evidence. **Current Opinions in Neurology,** vol. 13, (pt. 4), pp. 415-421.

CARLSON, S., RAMA, P., ARTCHAKOV, D. and LINNANKOSKI, I. (1997 September) Effects of music and white noise on working memory performance in monkeys. **Neuroreport**, vol. 8 (pt. 13), pp. 2853-2856.

CARSTENS, C. B., HUSKINS, E. and HOUNSHELL, G. W. (1995) Listening to Mozart may not enhance performance on the revised Minnesota Paper Form Board Test. **Psychological Reports,** vol. 77, pp. 111-114.

CARTER, R. (1998) **Mapping the Mind,** Los Angeles, University of California Press.

CARTLING, B. (1999, April) Control of resolution and perception in working memory. **Behavioural Brain Research,** vol. 100 (pt. 1-2), pp. 255-271.

CHAO, L. L. and KNIGHT, R. T. (1998, March) Contribution of human prefrontal cortex to delay performance. **Journal of Cognitive Neuroscience,** vol. 10 (pt. 2), pp. 167-177.

CHELAZZI, L., DUNCAN, J., MILLER, E. K. and DESIMONE, R. (1998, December) Responses of neurons in inferior temporal cortex during memory-guided visual search. **Journal of Neurophysiology,** vol. 80 (pt. 6), pp. 2918-2940.

CHEOUR, M., ALHO, K., CEPONIENE, R., REINIKAINEN, K., SAINIO, K., POHJAVUORI, M., AALTONEN, O. and NAATANEN, R. (1998, July) Maturation of mismatch negativity in infants. **International Journal of Psychophysiology,** vol. 29 (pt. 2), pp. 217-226.

CHERRY, K. E. and LECOMPTE, D. C. (1999, March) Age and individual differences influence prospective memory. **Psychology and Aging,** vol. 14 (1), pp. 60-76.

CHIEFFI, S., ALLPORT, D. A. and WOODIN, M. (1999, April) Hand-centred coding of target location in visuo-spatial working memory. **Neuropsychologia,** vol. 37 (pt. 4), pp. 495-502.

CHUDLER, E.H. (2000) Explore the Nervous System.
http://faculty.washington.edu/chudler/neurok.html.
(23 August, 2000)

CHUDLER, E.H. (2000) Lobes of the Brain.
http://faculty.washington.edu/chudler/lobe.html,
(23 August, 2000)

CHURCHLAND, P. S. (1996) **Neurophilosophy-Toward a Unified Science of the Mind/Brain, Cambridge**, The Massachusetts Institute of Technology.

COLOMBO, M., D'AMATO, M. R., RODMAN, H. R. and GROSS, C. G. (1990, January 19) Auditory association cortex lesions impair auditory short-term memory in monkeys. **Science,** vol. 247 (pt. 4940),
pp. 336-338.

CONRAD, T. (1997) All Sides Now (Sound Recording Review). **Down Beat,** December; vol. 64 (pt. 112), pp. 80-81.

COOKE, ROBERT. (1998, November 12) Naming That Tune, and Much More (Study Links Music With Improved Verbal Skills). **Newsday**, p. A26

CORREIA, C. M., MUSZKAT, M., DEVINCENZO, N. S. and DECAMPOS, C. J. (1998 December) Laterality of musical functions in partial epilepsy. **Arquiros De Neuro-Psiquiatria,** vol. 56 (pt. 4),
pp. 747-755.

COURTEN-MYERS, G. M. D. (1999, March) The human cerebral cortex: gender differences in structure and function. **Journal of Neuropathology and Experimental Neurology,** vol. 58 (pt. 3), pp. 217-226.

CRUMMER, G. C., WALTON, J. P., WAYMAN, J. W., HANTZ, E. C. and FRISINA, R. D. (1994) Neural processing of musical timbre by musicians, nonmusicians, and musicians possessing absolute pitch. **Journal of the Acoustic Society of America,** May; vol. 95 (pt. 1), pp. 2720-2727.

CSEPE, V. and MOLNAR, M. (1997, September/October) Towards the possible clinical application of the mismatch negativity component of event-related potentials. **Audiology and Neuro-Otology,** vol. 2 (pt. 5), pp. 354-369.

DEMANY, L. and ARMAND, F. (1984, July) Infant timbre perception: discrimination of spectral envelopes. **Journal of the Acoustical Society of America,** vol. 76 (pt. 1), pp. 57-65.

DEMOREST, S.M., and MORRISON, S.J. (2000, September) Does music make you smarter? **Music Educators Journal,** vol. 87, (pt. 2), pp. 33-39, 58.

DEOUELL, L. Y., BENTIN, S. and GIARD, M. H. (1998, July) Mismatch negativity in dichotic listening: evidence for interhemispheric differences and multiple generators. **Psychophysiology,** vol. 35 (pt. 4), pp. 355-365.

DEOUELL, L. Y. and BENTIN, S. (1998, November) Variable cerebral responses to equally distinct deviance in four auditory dimensions: a mismatch negativity study. **Psychophysiology,** vol. 35 (pt. 6), pp. 745-754.

D'ESPOSITO, M., ZARAHN, E. and AGUIRRE, G. K. (1999, January) Event-related functional MRI: implications for cognitive psychology. **Psychological Bulletin,** vol. 125 (pt. 1), pp. 155-164.

DEY, I. (1993) **Qualitative Data Analysis**, London, Routledge

DITTMANN-BALCAR, A., THIENEL, R., SCHALL,U. (1999, December 16) Attention-dependent allocation of auditory processing resources as measured by mismatch negativity. **Neuroreport,** vol. 10 (pt. 18), pp. 3749-3753.

DIXON, M.J., PISKOPOS, M., and SCHWEIZER, T.A. (2000, June-August) Musical instrument naming impairments: the crucial exception to the living/nonliving dichotomy in category-specific agnosia. **Brain and Cognition,** vol. 43 (pt. 1-3), pp. 158-164.

DOBKIN, B. H. (1986) **Brain Matters: Stories of a Neurologist and His Patients,** New York, Crown Publishers Inc.

DUPLESSIS, W. F. and VANJAARSVELD, P. E. (1988) Audio-psycho-phonology: A comparative outcome study on anxious primary school pupils. **South African Journal of Psychology,** vol. 18 (pt. 4), pp. 144-151.

DUPLESSIS, W. F. and VANJAARSVELD, P. E. (1988) Audio-psycho-phonology at Potchefstroom: A review. **South African Journal of Psychology,** vol. 18 (pt. 4), pp. 136-143.

ELBERT, T., PANTEV, C., WIENBRUCH, C., ROCKSTROH, B. and TAUB, E. (1995, October 13) Increased cortical representation of the fingers of the left hand in string players. **Science,** vol. 270 (pt. 5234), pp. 305-307.

ELLIS, A. (1995, November) Pat Martino: creative force, 2 vols. (video recording review). **Guitar Player,** vol. 29 (pt. 11), pp. 127.

ELLIS, A. (1998) Head and Heart (Sound Recording Review). **Guitar Player,** May; vol. 32 (pt. 5), pp. 127-128.

ELLIS-HILL, C.S., and HORN, S. (2000) Change in identity and self-concept: a new theoretical approach to recovery following a stroke. **Clinical Rehabilitation,** vol. 14, pp. 279-287.

ENGLE, R. W., FIDLER, D. S. and REYNOLDS, L. H. (1981, December) Does echoic memory develop? **Journal of Experimental Child Psychology,** vol. 32 (pt. 3), pp. 459-473.

EPHLAND, J. (1995, August) The Maker (sound recording review). **Down Beat,** vol. 62 (pt. 2), pp. 42-43.

ERDONMEZ, D., and MORLEY, J.B. (1981) Preservation of acquired music performance functions with a dominant hemisphere lesion: a case report. **Journal of Clinical Experimental Neuropsychology,** vol. 20, (pt. 1), pp. 83-87.

ESTANOL, B. and MENDEZ, A. (1998 April) A case of cortical amusia in a patient with musical ability. **Revista De Neurologia**, vol. 26 (pt. 152), pp. 612-615.

EUSTACHE, F., DESGRANGES, B. and LALEVEE, C. (1998) Clinical evaluation of memory. **Revue Neurologique,** vol. 154 (pt. Suppl 2), pp. 18-32.

FAGGRO, F., BRUSAFERRO, A., and BAVA, A. (1990) Opposite musical-manual interference in young vs. expert musicians. **Neuropsychologia,** vol. 28 (8), pp. 817-877.

FAGEN, J., PRIGOT, J., CARROLL, M., PIOLI, L., STEIN, A. and FRANCO, A. (1997, December) Auditory context and memory retrieval in young infants. **Child Development,** vol. 68 (pt. 6), pp. 1057-1066.

FALLO, P. (Director) (1993), **Pat Martino-Open Road** (Video Tape), New York, U.S.A.: Phil Fallo Productions.

FALLO, P. (Director) (1993), **Pat Martino-Live At Ethel's Place** (Video Tape), New York, U.S.A. : Phil Fallo Productions.

FLOHR, J.W., MILLER, D.C., and DEBEUS, R. (2000, September) EEG studies with young children. **Music Educators Journal,** vol. 87, (pt. 2), pp. 28-32.

FROST, J. A., BINDER, J. R., SPRINGER, J. A. and HAMMEKE, T. A. (1999, February) Language processing is strongly left lateralized in both sexes: evidence from functional MRI. **Brain**, vol. 122 (pt. 2), pp. 199-208.

FUJI, T., OKUDA, J., KAWASHIMA, R., YAMADORI, A., FUKATSU, R., SUZUKI, K., ITO, M., GOTO, R. and FUKUDA, H. (1997, March 24) Different roles of the left and right parahippocampal regions in verbal recognition: a PET study. **Neuroreport,** vol. 8 (pt. 5), pp. 1113-1117.

GAETA, H., FRIEDMAN, D., RITTER, W., CHENG, J. (1998, September/October) An event-related potential study of age-related changes in sensitivity to stimulus deviance. **Neurobiological Aging,** vol. 19 (pt.5), pp. 447-459.

GANDOUR, J., WONG, D. and HUTCHINS, G. (1998, June 22) Pitch processing in the

human brain is influenced by language experience. **Neuroreport,** vol. 9 (pt. 9), pp. 2115-2119.

GANNON, P. J., HOLLOWAY, R. L., BROADFIELD, D. C. and BRAUN, A. R. (1998, January 9) Asymmetry of chimpanzee planum temporale: humanlike pattern of Wernicke's brain language area homolog. **Science,** vol. 279 (pt. 5348), pp. 220-222.

GATHERCOLE, S. E. and HITCH, G. J. (1993) Developmental changes in short-term memory: a revised working memory perspective. In: COLLINS, A. F., GATHERCOLE, S. E., CONWAY, M. A. and MORRIS, P. E. ed. **Theories of Memory,** Hove, Lawrence Erlbaum Associates Ltd. pp. 189-210.

GIAKOUMAKI, E. S. (1996) Mothering in tune to women's musical preferences in the immediate post-partum period: a musical, exploratory approach. **1st Clinic of Obstetrics and Gynaecology,** University of Athens

GIBSON, J. R. and MAUNSELL, J. H. (1997, September) Sensory modality specificity of neural activity related to memory in visual cortex. **Journal of Neurophysiology,** vol. 78 (pt. 3), pp. 1263-1275.

GILMAN, S., NEWMAN, S.W. (1992) **Essentials of Clinical Neuroanatomy and Neurophysiology.** Edition 9, Philadelphia, F.A. Davis Company.

GLENBERG, A. M. (1984, January) A retrieval account of the long-term modality effect. **Journal of Experimental Psychology: Learning, Memory, and Cognition,** vol. 10 (pt. 1), pp. 16-31.

GOTESTAM, K. O. (1990) Lefthandedness among students of architecture and music. **Perception and Motor Skills,** June; vol. 30 (pt. 2), pp. 1323-1327.

GRAU, J. W. and NELSON, D. G. K. (1988) The distinction between integral and separable dimensions: evidence for the integrality of pitch and loudness. **Journal of Experimental Psychology:General,** vol. 117 (pt. 4), pp. 347-370.

GRAU, C., ESCERA, C., YAGO, E. and POLO, M. D. (1998, August 3) Mismatch negativity and auditory sensory memory evaluation: a new faster paradigm. **Neuroreport,** vol. 9 (pt. 11), pp. 2451-2456.

GRAZIANO, A. B., PETERSON, M. and SHAW, G. L. (1999, March) Enhanced learning of proportional math through music training and spatial-temporal training. **Neurological Research,** vol. 21 (pt. 2), pp. 139-152.

HADANO, K., NAKAMURA, H., and HAMANAKA, T. (1998, February) Effortful echolalia. **Cortex,** vol. 34, pt. (1), pp. 67-82.

HANTZ, E. C., MARVIN, E. W., KREILICK, K. G. and CHAPMAN, R. M. (1996 October) Sex differences in memory for timbre: an event-related potential study. **International Journal of Neuroscience,** vol. 87 (pt. 1-2), pp. 17-40.

HARASTY, J., DOUBLE, K. L., HALLIDAY, G. M., KRIL, J. J. and MCRITCHIE, D. A. (1997, February) Language-associated cortical regions are proportionally larger in the female brain. **Archives of Neurology,** vol. 54 (pt. 2), pp. 171-176.

HARTMANN, E. (1998, November 20) Music as Food for the Brain. **Science**, vol. 282 (pt. 5393), pp. 1409.

HASHIMOTO, R., HAMAE, F., NAKAJIMA, K., MIYASHITA, Y., and SAKAI, K.L. (2000 August) Functional differentiation in the human auditory and language areas revealed by a dichotic listening task. **Neuroimage,** vol. 12 (pt. 2), pp. 147-158.

HASSLER, M. and GUPTA, D. (1993, July) Functional brain organization, handedness, and immune vulnerability in musicians and non-musicians. **Neuropsychologia**, vol. 31 (pt. 7), pp. 655-660.

HEBERT, S. and PERETZ, I. (1997) Recognition of music in long-term memory: are melodic and temporal patterns equal partners? **Memory and Cognition,** vol. 25 (pt. 4), pp. 518-33.

HENSON, R. (1977) Neurological aspects of musical experience. In: CRITCHLEY, M. and HENSON, R. ed. **Music and the Brain**, London, William Heinemann Medical Books Limited, Ltd. pp. 3-21.

HILTS, P. F. (1995) **Memory's Ghost,** New York, Simon and Shuster.

HIRSHMAN, E. and MASTER, S. (1997) Modeling the conscious correlates of recognition memory: reflections on the remember-know paradigm. **Memory and Cognition,** vol. 25 (pt. 3), pp. 345-51.

HIRST, W. (1993) MEM: Memory subsystems as processes. In: COLLINS, A. F., GATHERCOLE, S. E., CONWAY, M. A. and MORRIS, P. E. ed. **Theories of Memory**, Hove, Lawrence Erlbaum Associates Ltd. pp. 241-286.

HOFMAN, S., KLEIN, C. and ARLAZOROFF, A. (1993, June) Common hemisphericity of language and music in a musician. A case report. **Journal of Communication Disorders,** vol. 26 (pt. 2), pp. 73-82.

HOLTZ, R. L. (1997, August 28) Watching memories in the making; researchers track individual neurons, finding that they retain experiences long after conscious recollection has faded. **Los Angeles Times,** p. B-2.

HOWARD, P. J. (1994) **The Owner's Manual for the Brain,** Austin, Leornian Press.

ICHIKAWA, H., SUGITA, K., KAWAMURA, M., FUKUI, T., and SHIOTA, J. (1995, April) Mirror movements observed inpatients skilled in playing the piano-symptomatological study. **Rinsho Shinkeigaku,** vol. 35 (pt. 4) pp. 368-372.

IZQUIERDO, I., IZQUIERDO, L. A., BARROS, D. M., SOUZA, T. M. E., SOUZA, M. M. D., QUEVEDO, J., RODRIGUES, C., SANT'ANNA, M. K., MADRUGA, M. and MEDINA, J. H. (1998, September) Differential involvement of cortical receptor mechanisms in working, short-term and long-term memory. **Behavioural Pharmacology,** vol. 9 (pt. 5-6), pp. 421-427.

JENKINS, J.S. (1991, October) The medical history and death of Mozart. **Journal of the Royal College of Physicians of London.** vol. 25 (pt. 4), pp. 351-353.

JOHNSRUDE, I. S., ZATORRE, R. J., MILNER, B. A. and EVANS, A. C. (1997, May 6) Left-hemisphere specialization for the processing of acoustic transients. **Neuroreport,** vol. 8 (pt. 7), pp. 1761-1765.

JONES, G. V. (1993) Problems and solutions in memory and cognition. In: COLLINS, A. F., GATHERCOLE, S. E., CONWAY, M. A. and MORRIS, P. E. ed. **Theories of Memory**, Hove, Lawrence Erlbaum Associates, Ltd. pp. 286-302.

JONES, R., HUX, K., MORTON-ANDERSON, K. and KNEPPER, L. (1994, February) Auditory stimulation effect on a comatose survivor of traumatic brain injury. **Archives of Physical Medicine and Rehabilitation.,** vol. 75 (pt. 2), pp. 164-171.

JONES, R. (1995, November) Smart Brains. **The American School Board Journal,** pp. 22-26.

JONES, R.T. (1977, November) "You won't play the piano anymore." **Readers Digest,** Pleasantville, The Reader's Digest Association, Inc.

JONES, S. J. and BYRNE, C. (1998) The AEP T-complex to synthesized musical tones: left-right asymmetry in relation to handedness and hemisphere dominance. **Electroencephalography and Clinical Neurophysiology,** July; vol. 108 (pt. 4), pp. 355-360.

JOSSELYN, J. (1996, February) Pat Martino's electric guitar-solo on 'Catch'. **Down Beat,** vol. 63 (pt. 2), pp. 56-57.

JOUTSINIEMI, S. L., ILVONEN, T., SINKKONEN, J., HURTILAINEN, M., TERVANIEMI, M., LEHTOKOSKI, A., RINNE, T. and NAATANEN, R. (1998, March) The mismatch negativity for duration decrement of auditory stimuli in healthy subjects. **Electroencephalography and Clinical Neurophysiology,** vol. 108 (pt. 2), pp. 154-159.

JUDD, T., GARDNER, H. and GESCHWIND, N. (1983 June) Alexia without agraphia in a composer. **Brain,** vol. 106 (pt. 2), pp. 435-457.

KAPUR, N. (1988) **Memory Disorders in Clinical Practice,** London, Butterworth & Co.

KATHMANN, N., FRODL-BAUCH, T. and HEGERL, U. (1999, February) Stability of the mismatch negativity under different stimulus and attention conditions. **Clinical Neurophysiology,** vol. 110 (pt. 2), pp. 317-323.

KATO, T., ERHARD, P., TAKAYAMA, Y., STRUPP, J., LE, T. H., OGAWA, S. and UGURBIL, K. (1998, April 20) Human hippocampal long-term sustained response during word memory processing. **Neuroreport,** vol. 9 (pt. 6), pp. 1041-1047.

KAY, A.D., THORNHILL, S., TEASDALE, G.M. (2001) The head injured adult-who cares? **British Journal of Neurosurgery,** vol. 15, (pt. 6), pp. 508-510.

KEITH, M. S., STANISLAV, S. W. and WESNES, K. A. (1998, December) Validity of a cognitive computerized assessment system in brain-injured patients. **Brain Injury,** vol. 12 (pt. 12), pp. 1037-1043.

KERSHNER, J. R. (1990) Two-year evaluation of the Tomatis listening training program with learning disabled children. **Learning Disability Quarterly,** Winter; vol. 13 (pt. 1), pp. 43-53.

KILLGORE, W.D., CASASANTO, D.J., YURGELUN-TODD, D.A., MALDJIAN, J.A. and DETRE, J.A. (2000 July 14) Functional activation of the left amygdala and hippocampus during associative encoding. **Neuroreport,** vol. 11 (pt. 10), pp. 2259-2263.

KLAWANS, H.L. (1990) **Newton's Madness-Further Tales of Clinical Neurology,** New York, Harper & Row.

KNIGHT, R.G., DEVEREUX, R., and GODFREY, H.P.D. (1998) Caring for a family member with a traumatic brain injury. **Brain Injury,** vol. 12, (pt. 6), pp. 467-481.

KOIKE, A., SHIMIZU, H., ISHIJIMA, B. and SUGISHITA, M. (1996) Preserved musical abilities following right temporal lobectomy. **Journal of Neurosurgery,** December; vol. 85 (pt. 6), pp. 1000-1004.

KRINGS, T., TOPPER, R., FOLTYS, H., ERBERICH, S., SPARING, R., WILLMES K., THRON, A. (2000, January 14) Cortical activation patterns during complex motor tasks in piano players and control subjects. A functional magnetic resonance imaging study. **Neuroscience Letters**, vol. 278 (3), pp. 189-193.

KRIS, E. (1975) **The Selected Papers of Ernst Kris.,** New Haven, Yale University Press.

LANE, R. D., REIMAN, E. M., BRADLEY, M. M., LANG, P. J., AHERN, G. L., DAVIDSON, R. J. and SCHWARTZ, G. E. (1997, November) Neuroanatomical correlates of pleasant and unpleasant emotion. **Neuropsychologia,** vol. 35 (pt. 11), pp. 1437-1444.

LASSONDE, M., MOTTRON, L., PERETZ, I., SCHIAVETTO, A., HEBERT, S., DECARIE, J.C. (1999) Loss of Global Visual and Auditory Processing following right temporal lobe lesion. **Brain,** vol.121 (pt.1) 162-170.

LEVANEN, S. and SAMS, M. (1997) Disrupting human auditory change detection: Chopin is superior to white noise. **Psychophysiology,** May; vol. 34 (pt. 3), pp. 258-265.

LEVIN, H. S. and ROSE, J. E. (1979 February) Alexia without agraphia in a musician after transcallosal removal of a left intraventricular meningioma. **Neurosurgery**, vol. 4 (pt. 2), pp. 168-174.

LEVITIN, D. and COOK, P. (1996, August) Memory for musical tempo: additional evidence that auditory memory is absolute. **Perception and Psychophysics,** vol. 58 (pt. 6), pp. 927-935.

LEVY, E. (1998, January) Lick of the Month: Martino goes Schoenberg. **Guitar Player,** vol. 32 (pt. 1), pp. 133.

LOFTUS, E. and LOFTUS, G. (1980) On the permanence of stored information in the human brain. **American Psychologist,** vol. 35 pp. 49-72.

LUTKENHONER, B. and STEINSTRATER, O. (1998, March-June) High-precision neuromagnetic study of the functional organization of the human auditory cortex. **Audiology and Neuro-otology,** vol. 3 (pt. 2-3), pp. 191-213.

LYNCH, M. P., EILERS, R. E. and BORNSTEIN, M. H. (1992) Speech, vision, and music perception: windows on the ontogeny of the mind. **Psychology of Music**, vol. 20. pp. 3-14.

LYNCH, M., SHORT, L. and CHUA, R. (1995, November) Contributions of experience to the development of musical processing in infancy. **Developmental Psychobiology,** vol. 28 (pt. 7), pp. 377-398.

MACNIE, J. (1997, March) Agony and the Ecstasy-Pat Martino and Les Paul. **Down Beat,** vol. pp. 16-21.

MAGUIRE, E.A., FRITH, C.D., and MORRIS, R.G.M. (1999) The functional neuroanatomy of comprehension and memory: the importance of prior knowledge. **Brain,** vol. 122, pp. 1839-1850.

MANDEL, H. (1995) Pat Martino: Open Road (video recording review). **Down Beat,** vol. 62 (pt. 7), p. 58.

MARTIN, R. (1986) **Matters Gray & White- A Neurologist, His Patients, and the Mysteries of the Brain.** New York, Henry Holt and Company.

MARTINO, P. (1968) **Bayina (The Clear Evidence)** (Compact Disc) U.S.A.: Prestige Records PR7589.

MARTINO, P. (1994) **Interchange** (Compact Disc) U.S.A.: Muse Records MCD 5529.

MARTINO, P. (1995) **The Maker** (Compact Disc) U.S.A.: Evidence ECD 22121-2.

MARTINO, P. (1997) **All Sides Now** (Compact Disc) U.S.A.: Blue Note CDP 724383762729.

MATEER, C. and KERNS, K. A. (1996, December 1) Management of attention and memory disorders following traumatic brain injury. **Journal of Learning Disabilities,** vol. 29 (pt. 1), pp. 618-657.

MATTEIS, M., SILVESTRINI, M., TROISI, E., CUPINI, L. M. and CALTAGIRONE, C. (1997, July) Transcranial doppler assessment of cerebral flow velocity during perception and recognition of melodies. **The Journal of Neurological Science,** vol. 149 (pt. 1), pp. 57-61.

MAY, P., TIITINEN, H., ILMONIEMI, R.J., NYMAN, G., TAYLOR, J.G., NAATANEN, R. (1999, March/April) Frequency change detection in human auditory cortex. **Journal of Computational Neuroscience,** vol. 6 (pt.2) pp. 99-120.

MAZZUCCHI, A., CATTELANI, R. and UMILTA, C. (1983, January) Hemispheric prevalence in acoustical attention. **Brain and Cognition**, vol. 2 (pt. 1), pp. 1-11.

MCPHAIL, J. C. (1995, May 1) Phenomenology as philosophy and method. **Remedial and Special Education,** vol. 16 (pt. 1), pp. 159-177.

MENDEZ, M. F. and GEEHAN, G. R. (1988, January) Cortical auditory disorders: clinical and psychoacoustic features. **Journal of Neurology, Neurosurgery, and Psychiatry,** vol. 51 (pt. 1), pp. 1-9.

MESERLI, P., PEGNA, P. and SORDET, N. (1995) Hemispheric dominance for melody recognition in musicians and non-musicians. **Neuropsychologia,** April; vol. 33 (pt. 4), pp. 395-405.

MICHEYL, C., KHALFA, S., PERROT, X. and COLLET, L. (1997 March) Difference in cochlear efferent activity between musicians and non-musicians. **Neuroreport**, vol. 8 (pt. 4), pp. 1047-1050.

MILKOWSKI, B. (1996, May) The maker (sound recording review). **Audio,** vol. 80 (pt. 5), pp. 85-86.

MISHLER, E. G. (1986) **Research Interviewing-Context and Narrative,** Cambridge, Harvard University Press.

MOLFESE, D. L. (1984, May) Left hemisphere sensitivity to consonant sounds not displayed by the right hemisphere: electrophysiological correlates. **Brain and Language,** vol. 22 (pt. 1), pp. 109-127.

MUSIEK, F. E. and REEVES, A. G. (1990, October) Asymmetries of the auditory areas of the cerebrum. **Journal of the American Academy of Audiology,** vol. 1 (pt. 4), pp. 240-245.

MUSZKAT, M., CORREIA, C., NOFFS, M., VINCENZO, N. D. and CAMPOS, C. D. (1995, March) Hemispheric functional specialization in motor aphasia. Neurophysiologic

findings with computerized electroencephalographic brain mapping during musical and oral sound stimulation. Study of two cases. **Arquivos De-Neuro-Psiquiatria,** vol. 53 (pt. 1), pp. 88-93.

NAKADA, T., FUJII, Y., SUZUKI, K. and KWEE, I. L. (1998, December 1) Musical brain revealed by high-field (3 Tesla) functional MRI. **Neuroreport,** vol. 9 (pt. 17), pp. 3853-3856.

NELSON, R. (1998, January 8) Similarities found in human, chimp brains. Columbia University. Office of Public Affairs. (May, 2000).

NEWMAN, J., ROSENBACH, J., BURNS, K., LATIMER, B., MATOCHA, H. and VOGT, E. (1995, December) An experimental test of "the Mozart effect": does listening to his music improve spatial ability? **Perceptual and Motor Skills,** vol. 81 (pt. 2), pp. 1379-1387.

NICKELS, L., HOWARD, D. and BEST, W. (1997, February 1) Fractionating the articulatory loop: dissociations and associations in phonological recoding in aphasia. **Brain and Language,** vol. 56 (pt. 2), pp. 161-182.

NOTTONO, H. (1984, June) Background instrumental music and serial recall. **Perceptual Motor Skills,** vol. 84 (pt. 2), pp. 1307-1313.

OADES, R. D., DITTMANN-BALCAR, A. and ZERBIN, D. (1997, November) Development and topography of auditory event-related potentials (ERP's): mismatch and processing negativity in individuals 8-22 years of age. **Psychophysiology,** vol. 34 (pt. 6), pp. 677-693.

O'BOYLE, M. W., BORMANN, L. and HARTS, K. (1990, December) How knowledge of the song influences the matching of "melodies"; to rhythm sequences tapped in the right and left palms. **Cortex,** vol. 26 (pt. 4), pp. 639-642.

OOHASHI, T., NISHINA, E., HONDA, M., YONEKURA, Y., FUWAMOTO, Y., KAWAI, N., MAEKAWA, T., NAKAMURA, S., FUKUYAMA, H., and SHIBASAKI, H. (2000, June) Inaudible high-frequency sounds affect brain activity: hypersonic effect. **Journal of Neurophysiology,** vol.83, (pt. 6), pp. 3548-3558.

OPPENHEIM, A. N. (1966) **Questionnaire Design and Attitude Measurement,** New York, Basic Books, Inc.

ORNSTEIN, R. (1997) **The Right Mind,** San Diego, Harcourt Brace and Company

OSCAR-BERMAN, M., BLUMSTEIN, S., and DE LUCA, D. (1976, September) Iconic recognition of musical symbols in the lateral visual fields. **Cortex,** vol. 12, (pt. 3), pp. 241-248.

OSTWALD, P. F. (1973) Musical Behavior in Early Childhood. **Developmental Medicine and Child Neurology**, vol. 15 pp. 367-375.

OTSUKI, M., SOMA, Y., AOKI, K., LIZUKA, O., KOYAMA, A., YOSHIMURA, N., SAHARA, M., NAGAI, H., KOIKE, R. and TSUJI, S. (1998, November) Difference between transcortical sensory aphasia following the left frontal lesion and transcortical sensory aphasia following the left posterior lesion. **No To Shinkei.Brain and Nerve,** vol. 50 (pt. 11), pp. 995-1002.

PAAVILAINEN, P., JARAMILLO, M. and NAATANEN, R. (1998, September) Binaural information can converge in abstract memory traces. **Psychophysiology,** vol. 35 (pt. 5), pp. 483-487.

PAIVIO, A. (1975) Imagery and long-term memory. In: KENNEDY, A. and WILKES, A. ed. **Studies in Long-Term Memory**, London, John Wiley and Sons. pp. 57-85.

PALMER, W. A., MANUS, M. and VICLETHCO, A. (1973) **Alfred's Basic Piano Course-Level 1,** New York, Alfred.

PANG, E. W., EDMONDS, G. E., DESJARDINS, R., KHAN, S. C., TRAINOR, L. J. and TAYLOR, M. J. (1998, July) Mismatch negativity to speech stimuli in 8-month-old infants and adults. **International Journal of Psychophysiology,** vol. 29 (pt. 2), pp. 227-236.

PARSONS, L.M., HODGES, D.A. FOX, P.T. (1998, November) Neural Basis of The Comprehension of Musical Harmony, Melody, and Rhythm. **Society for Neuroscience Meeting.**

PARSONS, M. (1993) **Clinical Neurology 2nd ed.,** St. Louis, Mosby-Year Book.

PATEL, A., PERETZ, I., TRAMO, M. and LABREQUE, R. (1998, January) Processing prosodic and musical patterns: a neuropsychological investigation. **Brain and Language,** vol. 61 (pt. 1), pp. 123-144.

PATEL, A. D., GIBSON, E., RATNER, J., BESSON, M. and HOLCOMB, P. J. (1998 November) Processing syntactic relations in language and music: an event-related potential study. **Journal of Cognitive Neuroscience,** vol. 10 (pt. 6), pp. 717-7133.

PAULESU, E., FRITH, C. D. and FRACKOWIAK, R. S. (1993, March 25) The neural correlates of the verbal component of working memory. **Nature,** vol. 362 (pt. 6418), pp. 342-345.

PELOSI, L. and BLUMHARDT, L. D. (1999, January) Effects of age on working memory: an event-related potential study. **Brain Research. Cognitive Brain Research,** vol. 7 (pt. 3), pp. 321-334.

PEMBROOK, R. G. (1987) The effect of vocalization on melodic memory conservation. **Journal of Research in Music Education,** vol. 35 (pt. 3), pp. 155-169.

PENHUME, V.B., ZATORRE, R.J., and FEINDEL, W.H. (1999, March) The role of auditory cortex in retention of rhythmic patterns as studied in patients with temporal lobe

removals including Heschl's gyrus. **Neuropsychologia,** vol. 37 (pt. 3), 315-331.

PERRY, D.W., ZATORRE, R.J., PETRIDES, M., ALIVISATOS, B., MEYER, E., and EVANS, A.C. (1999, December 16) Localization of cerebral activity during simple singing. **Neuroreport,** vol. 10 (pt. 18), pp. 3979-3984.

PETSCHE, H., POCKBERGER, H. and RAPPELSBERGER, P. (1985, December) Music perception, EEG and musical training. **EEG-EMG Zeitschrift Fur Elektroenzephalographie, Elektromy Ographie und Verwandte Gebiete,** vol. 16 (pt. 4), pp. 183-190.

PHILLIPS, W. and BADDELEY, A. (1989) Learning and Memory. In: BADDELEY, A. and BERNSEN, N. O. ed. **Cognitive Psychology (Research Directions in Cognitive Science: European Perspectives)**, London, Lawrence Erlbaum Associates. pp. 61-81.

POLZELLA, D. J. and HASSEN, J. L. (1997) Aesthetic preferences for combinations of color and music. **Perception and Motor Skills,** December; vol. 85 (pt. 1), pp. 960-962.

POORE, S. (2000) Ethnomethodology. http://www.hewett.norfolk.sch.uk/curric/soc/ethno/intro.html (15 September, 2000).

PORT, A., WILLMOTT, C., and CHARLTON, J. (2002) Self-awareness following traumatic brain injury and implications for rehabilitation. **Brain Injury,** vol. 16, (pt. 4), pp. 277-289.

POSNER, M.I., and RAICHLE, M.E. (1998, February 3) The neuroimaging of human brain function. **Proceedings of the National Academy of Sciences,** vol. 95 (pt.3) pp. 763-764.

POULSON, C. L., KYMISSIS, E., REEVE, K. F., ANDREATOS, M. and REEVE, L. (1991) Generalized Vocal Imitation in Infants. **Journal of Experimental Child Psychology**, vol. 51 pp. 267-279.

PRIOR, M., KINSELLA, G. and GIESE, J. (1990, March) Assessment of musical processing in brain-damaged patients: implications for laterality of music. **Journal of Clinical and Experimental Neuropsychology,** vol. 12, (pt. 2), pp. 301-312.

RAUSCHECKER, J. P. (1998, August) Cortical processing of complex sounds. **Current Opinion in Neurobiology,** vol. 8 (pt. 4), pp. 516-521.

RAUSCHECKER, J. P. (1999, February) Auditory cortical plasticity: a comparison with other sensory systems. **Trends in Neuroscience,** vol. 22 (pt. 2), pp. 74-80.

RAUSCHER, F. H. and SHAW, G. L. (1998) Key components of the Mozart effect. **Perceptual and Motor Skills,** June; vol. 86 (pt. 1), pp. 835-841.

REISSMAN, C.K. (1993) **Narrative Analysis,** London, Sage Publications, Inc.

RESNICOFF, M. (1995, May) The 12-point star: a conversation with Pat Martino. **Guitar Player,** vol. 29 (pt. 5), p. 136.

RESNICOFF, M. (1995, September) Pat Martino meets his maker; the resurrection of a jazz legend. (Interview). **Guitar Player,** vol. 29 (pt. 9), p. 39-43.

RESNICOFF, M. (1995, November) Legends of Jazz Guitar, 3 Vols. (video recording review). **Guitar Player,** vol. 29 (pt. 11), p. 116.

RESNICOFF, M. (1998, January) Looking for Paradise-A Producer's-Eye View of Pat Martino's Visionary Duets. **Guitar Player,** pp. 73-82.

RINKEL, G., BROUWERS, P. and LAMBRECHTS, D. (1997, April 12) Clinical judgement and decision making in clinical practice. A music conductor with epilepsy followed by memory disorders. **Nederlands Tijdschrift Voor Geneeskunde,** vol. 141 (pt. 15), pp. 723-726.

RINNE, T., ALHO, K., ALKU, P., HOLI, M., SINKKONEN, J., VIRTANEN, J., BERTRAND, O. and NAATANEN, R. (1999, April 6) Analysis of speech sounds is left-hemisphere predominant at 100-150ms after sound onset. **Neuroreport,** vol. 10 (pt. 5), pp. 1113-1117.

RITTER, W., SUSSMAN, E., MOLHOLM, S. (2000, January 17) Evidence that the mismatch negativity system works on the basis of objects. **Neuroreport,** vol. 11 (pt. 1), pp. 61-63.

ROEDERER, J. G. (1982) Music, Mind, and Brain. In: CLYNES, M. ed. **Physical and Neuropsychological Foundations of Music: The Basic Questions**, New York, Plenum Press. pp. 37-46.

ROME-FLANDERS, T. and CRONK, C. (1995) A longitudinal study of infant vocalizations during mother-infant games. **Journal of Child Language**, vol. 22 (pt. 2), pp. 259-274.

RONNBERG, J., LARSSON, C., FOGELSJOO, A., NILSSON, L. G., LINDBERG, M. and ANGQUIST, K. A. (1996, March) Memory dysfunction in mild aphasics. **Scandinavian Journal of Psychology,** vol. 37 (pt. 1), pp. 46-61.

RUCHKIN, D. S., BERNDT, R. S., JOHNSON, R., RITTER, W., GRAFMAN, J. and CANOUNE, H. L. (1997, October) Modality-specific processing streams in verbal working memory: evidence from spatio-temporal patterns of brain activity. **Brain Research. Cognitive Brain Research,** vol. 6 (pt. 2), pp. 95-113.

RUMELHART, D. E., LINDSAY, P. H. and NORMAN, D. A. (1972) A process model for long-term memory. In: TULVING, E. and DONALDSON, W. ed. **Organization of Memory**, New York, Academic Press. pp. 303-326.

SAMSON, S., ZATORRE, R. J. and RAMSAY, J. O. (1997, December) Multidimensional

scaling of synthetic musical timbre: perception of spectral and temporal characteristics. **Canadian Journal of Experimental Psychology,** vol. 51 (pt. 4), pp. 307-315.

SAMSON, S. and ZATORRE, R. J. (1994, February) Contribution of the right temporal lobe to musical timbre discrimination. **Neuropsychologia,** vol. 32 (pt. 2), pp. 231-240.

SCHELLENBERG, E. G. and TREHUB, S. E. (1996, September) Natural musical intervals: evidence from infant listeners. **Psychological Science,** vol. 7 (pt. 5), pp. 272-277.

SCHIAVETTO, A., CORTESE, F. and ALAIN, C. (1999, August 20) Global and local processing of musical sequences: an event-related brain potential study. **Neuroreport,** vol. 10 (12), pp. 2467-2472.

SCHMIDT, J. M., VERSCHUURE, J. and BROCAAR, M. P. (1994) Hearing loss in students at a conservatory. **Audiology,** July; vol. 33 (pt. 4), pp. 185-194.

SCHUTZ, A. (1970) **On Phenomenology and Social Relations,** 3rd. Chicago, The University of Chicago Press.

SCOTT, C. R. (1989, October) How Children Grow Musically. **Music Educators Journal**, pp. 28-31.

SEGALOWITZ, S. J. and LANTERY, P. (1985, January) Music draws attention to the left and speech draws attention to the right. **Brain and Cognition,** vol. 4 (pt. 1), pp. 1-6.

SEIDMAN, I. (1998) **Interviewing as Qualitative Research- A Guide for Researchers in Education and the Social Sciences,** 2nd New York, Teachers College Press.

SHANON, B. (1984, December) Asymmetries in musical aesthetic judgments. **Cortex,** vol. 20 (pt. 4), pp. 567-573.

SHARMA, A. and DORMAN, M. F. (1998, July) Exploration of the perceptual magnet effect using the mismatch negativity auditory evoked potential. **Journal of the Acoustical Society of America,** vol. 104 (pt. 1), pp. 511-517.

SHERRY, D. F. and SCHACTER, D. L. (1987) The evolution of multiple memory systems. **Psychological Review,** vol. 94 (pt. 4), pp. 439-454.

SHREEVE, J. (1996, October) Music of the hemispheres: why can a toddler sing? Why is even the most ordinary human brain a library of melodies? **Discover Magazine,** vol. 17, pp. 90-99.

SHTYROV, Y., KUJALA, T., AHVENINEN, J., TERVANIEMI, M., ALKU, P., ILMONIEMI, R. J. and NAATANEN, R. (1998, July 24) Background acoustic noise and the hemispheric lateralization of speech processing in the human brain: magnetic mismatch negativity study. **Neuroscience Letters,** vol. 251 (pt. 2), pp. 141-144.

SHUTER-DYSON, R. and GABRIEL, C. (1981) **The Psychology of Musical Ability,** 2nd ed. London, Methuen.

SIDTIS, J. J. and FELDMAN, E. (1990, September) Transient ischemic attacks presenting with a loss of pitch perception. **Cortex,** vol. 26 (pt. 3), pp. 469-471.

SIEGFRIED, T. (1998, April 20) Making memories: science provides scattered picture of remembering. **The Dallas Morning News,** p. 6D.

SIGNORET, J., EECHHOUT, P. V., ONCET, M. and CASTAIGNE, P. (1987) Aphasia without amusia in a blind organist. Verbal alexia-agraphia without musical alexia-agraphia in braille. **Revue-Neurologique,** vol. 143 (pt. 3), pp. 172-181.

SCHUPPERT, M., MUNTE, T.F., WIERINGA, B.M., and ALTENMULLER, E. (2000, March) Receptive amusia: evidence for cross-hemispheric neural networks underlying music processing strategies. **Brain,** vol. 123 (pt. 3), pp. 546-559.

SIPE, S. and ENGLE, R. W. (1986, July) Echoic memory processes in good and poor readers. **Journal of Experimental Psychology: Learning, Memory, and Cognition,** vol. 12 (pt. 3), pp. 402-412.

SOUSOU, S. D. (1997) Effects of melody and lyrics on mood and memory. **Perceptual and Motor Skills**, vol. 85, pp. 31-40.

STAMBAUGH, L. (1996, November) Special learners with special abilities. **Music Educators Journal.**

STARR, G. and PITT, M. (1997, July) Interference effects in short-term memory for timbre. **Journal of the Acoustical Society of America,** vol. 102 (pt. 1), pp. 486-494.

STEPHENS, R. and RUNCIE, D. (1990, December) Individual differences in spatial and identity information processing in iconic memory. **Perceptual and Motor Skills,** vol. 71 (3 pt 2), pp. 1293-1294.

STEURER, M., SIMAK, S., DENK, D. M. and KAUTZKY, M. (1998) Does choir singing cause noise-induced hearing loss? **Audiology,** Jan-Feb; vol. 37 (pt. 1), pp. 38-51.

STEWART, L., AND WALSH, V. (2001) Neuropsychology: Music of the hemispheres, **Current Biology,** vol. 11, pp. R125-R127).

STROUSE, A., WILSON, R.H. (1999, November/December) Recognition of one-, two-, and three- pair dichotic digits under free and directed recall. **Journal of the American Academy of Audiology.** vol. 10 (pt. 10), pp. 557-571.

STUBBS, M. (1983) **Discourse Analysis,** Chicago, The University of Chicago Press.

SUSSMAN, E., RITTER, W. and VAUGHAN, H. G. (1998, April 6) Attention affects the

organization of auditory input associated with the mismatch negativity system. **Brain Research,** vol. 789 (pt. 1), pp. 130-138.

SUSSMAN, E., GOMES, H., NOUSAK, J. M., RITTER, W. and VAUGHAN, H. G. (1998, May 18) Feature conjunctions and auditory sensory memory. **Brain Research,** vol. 793 (pt. (1-2)), pp. 95-102.

SUSSMAN, E., RITTER, W. and VAUGHAN, H. (1999, January) An investigation of the auditory streaming effect using event-related brain potentials. **Psychophysiology,** vol. 36 (pt. 1), pp. 22-34.

TANAKA, Y., YAMADORI, A. and MORI, E. (1987, April) Pure word deafness following bilateral lesions. A psychophysical analysis. **Brain,** vol. 110 (pt. 2), pp. 381-403.

TIMMERMAN, M. E. and BROUWER, W. H. (1999 April) Slow information processing after very severe closed head injury: impaired access to declarative knowledge and intact application and acquisition of procedural knowledge. **Neuropsychologia**, vol. 37 (pt. 4), pp. 467-478.

TRAINOR, L. J. and TREHUB, S. E. (1993) Musical context effects in infants and adults: Key distance. **Journal of Experimental Psychology: Human Perception and Performance**, vol. 19 (pt. 3), pp. 615-626.

TRAINOR, L. J. and TREHUB, S. E. (1993, Winter) What mediates infants and adults superior processing of the major over the augmented triad? **Music Perception,** vol. 11 (pt. 2), pp. 185-196.

TURKINGTON, C. (1996) **The Brain Encyclopedia,** New York, Checkmark Books.

TYPMA, B., PRABHAKARAN, V., DESMOND, J. E., GLOVER, G. H. and GABRIELI, J. D. (1999, February) Load-dependent roles of frontal brain regions in the maintenance of working memory. **Neuroimage,** vol. 9 (pt. 2), pp. 216-226.

ULUALP, S. O., BISWAL, B. B., YETKIN, F. Z. and KIDDER, T. M. (1998, December) Functional magnetic resonance imaging of auditory cortex in children. **Laryngoscope,** vol. 108 (pt. 12), pp. 1782-1786.

VAN ESSEN, D.C., DRURY, H.A., JOSHI, SARANG., and MILLER, M.I. (1998, February 3) Functional and structural mapping of human cerebral cortex: Solutions are in the surfaces. **Proceedings of the National Academy of Sciences,** vol. 95 (pt. 3), pp. 788-795.

VERNY, T. and KELLY, J. (1981) **The Secret Life of the Unborn Child,** New York, The Bantam Doubleday Dell Publishing Group, Inc.

VERTOSICK, FRANK J., M.D. (1996) **When the Air Hits Your Brain-Tales of Neurosurgery**, New York, Random House, Inc.

WALKER, R., HUSAIN, M., HODGSON, T. L., HARRISON, J. and KENNARD, C. (1998, November) Saccadic eye movement and working memory deficits following damage to human prefrontal cortex. **Neuropsychologia,** vol. 36 (pt. 11), pp. 1141-1159.

WARBURTON, E., PRICE, C. J., SWINBURN, K. and WISE, R. J. (1999, February) Mechanisms of recovery from aphasia: evidence from positron emission tomography studies. **Journal of Neurology, Neurosurgery, and Psychiatry,** vol. 66 (pt. 2), pp. 155-161.

WATANABE, M. (1998) Cognitive and motivational operations in primate prefrontal neurons. **Reviews in the Neurosciences,** vol. 9 (pt. 4), pp. 225-241.

WHITEHEAD, K. (1988, June) Review-Pat Martino. **Down Beat,** p. 14.

WIESER, H. G. and MAZZOLA, G. (1986) Musical consonances and dissonances: are they distinguished independently by the right and left hippocampi? **Neuropsychologia,** vol. 24 (pt. 6), pp. 805-812.

WIESER, H. and WALTER, R. (1997, January) Untroubled musical judgement of a performing organist during early epileptic seizure of the right temporal lobe. **Neuropsychologia,** vol. 35 (pt. 1), pp. 45-51.

WILLINGHAM, D.B. (1998, November) What differentiates declarative and procedural memories: reply to Cohen, Poldrack, and Eichenbaum (1997). **Memory,** vol. 6 (pt. 6), pp. 689-699.

WILLIAMON, A., and VALENTINE, E. (2000, August) Quantity and quality of musical practice as predictors of performance quality. **British Journal of Psychology,** vol. 91 (pt. 3), pp. 353-376.

WILSON, B. A. and BADDELEY, A. (1993, March) Spontaneous recovery of impaired memory span: does comprehension recover? **Cortex,** vol. 29 (pt. 1), pp. 153-159.

WILSON, F. R. (1991, January) Music and the neurology of time. **Music Educators Journal,** pp. 26-30.

WYKE, M. A. (1977) Musical Ability: A Neurological Interpretation. In: CRITCHLEY, M. and HENSON, R. ed. **Music and the Brain (Studies in the Neurology of Music,** London, William Heinemann Medical Books Limited. pp. 156-173.

YABE, H., TERVANIEMI, M., SINKKONEN, J., HUOTILAINEN, M., ILMONIEMI, R. J. and NAATANEN, R. (1998, September) Temporal window of integration of auditory information in the human brain. **Psychophysiology,** vol. 35 (pt. 5), pp. 615-619.

YIN, R. K. (1984) **Case Study Research: Design and Methods,** Beverly Hills, Sage Publications, Inc.

ZALANOWSKI, A. H. (1990) Music appreciation and hemisphere orientation: visual

versus verbal involvement. **Journal of Research in Music Education,** vol. 38 (pt. 3), pp. 197-205.

ZARAHN, E., AGUIRRE, G. K. and D'ESPOSITO, M. (1999, January) Temporal isolation of the neural correlates of spatial mnemonic processing with fMRI. **Brain Research. Cognitive Brain Research,** vol. 7 (pt. 3), pp. 255-268.

ZAKHAROVA, N. N. and IVASHCHENKO, O. I. (1984, March-April) Effect of music on motor reaction time and interhemispheric relations. **Zhurnal Vysshei Nervnoi Deiatelnosti Imenti.P.Pavlova,** vol. 34 (pt. 2), pp. 212-218.